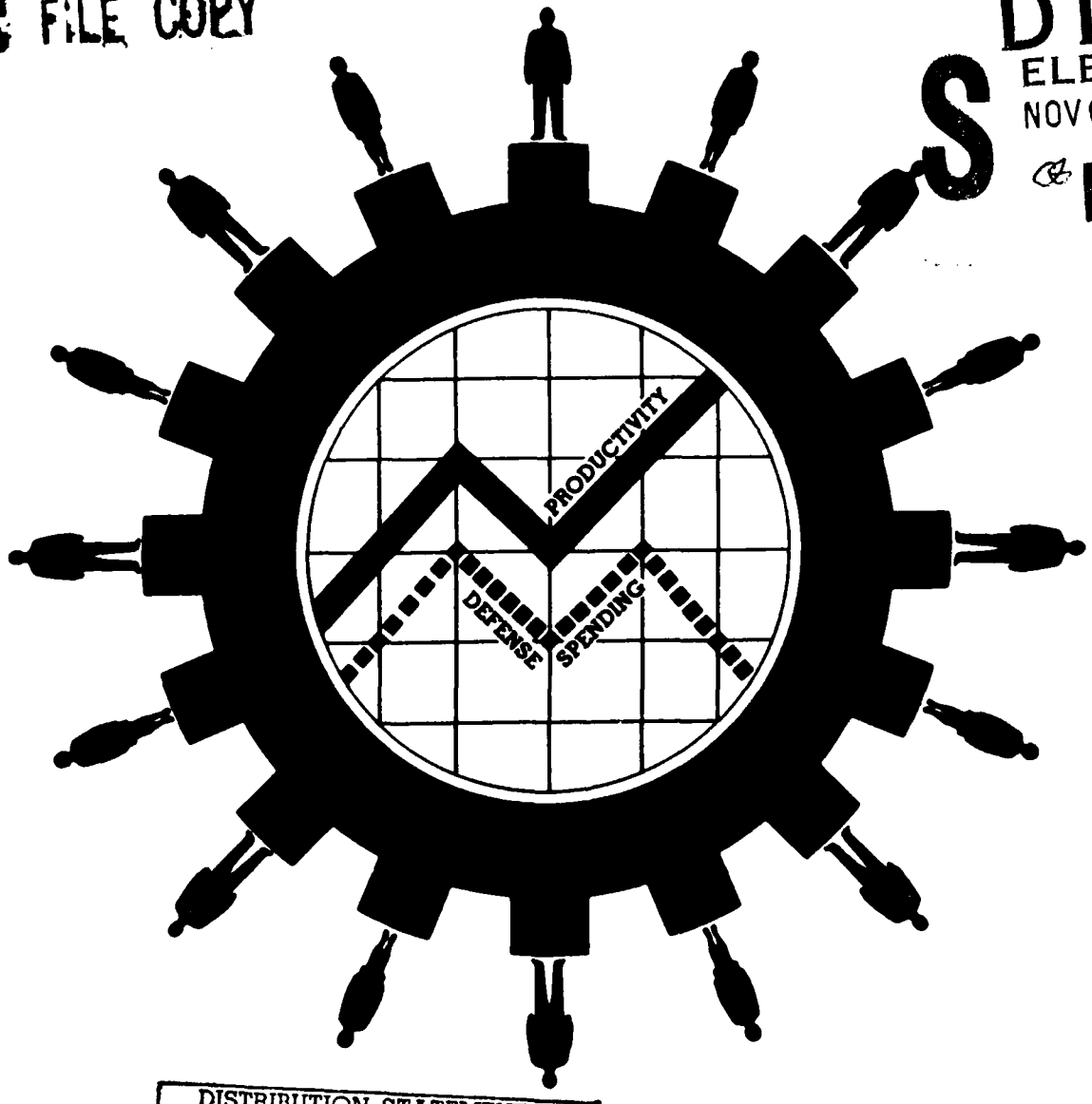
P R O C E E D I N G S

OF THE

"MANAGING THE INDUSTRIAL MODERNIZATION PROCESS" CONFERENCE



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Proceedings of the "Managing the Industrial Modernization Process" Conference is a collection of panel members' presentations and workshop proceedings. The Workshop presentations include: Balancing the Industrial Modernization Agenda--Commercial & Government; Preventing the Waste of Human Resources; Developing and Validating Capital Needs for Modernization; Integrating Statistical Thinking With Other Improvements; Balancing Short-term Financial Goals With Long-term Investment Requirements; The Industrial Modernization Incentives Program (IMIP); Flowing Policy Down To Suppliers; Are Industrial Networks and Product Data Exchange the Future?; The Use of Multifunctional Development Teams; What Is Needed In Curricula to Cover Industrial Modernization? The Proceedings include a keynote address by Deputy Secretary of Commerce Thomas J. Murrin.

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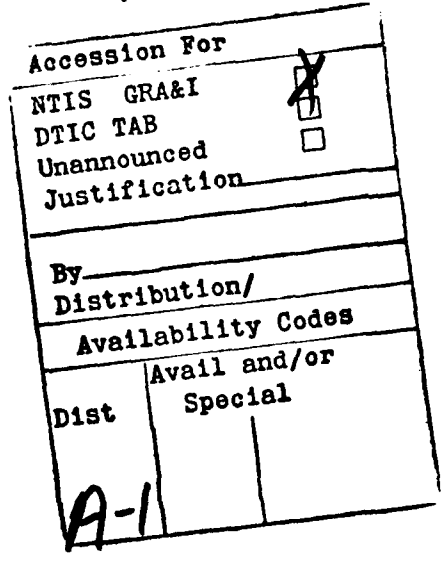
In Memory of

Dr. Richard L. DeLauer

Dr. DeLauer was scheduled to provide the luncheon address for the conference but was unable to attend because of illness. On April 22, 1990, Dr. DeLauer passed away. His passing is a great loss to the acquisition community. Dr. DeLauer had a long and distinguished career in the defense industry and Department of Defense. At the time of his death, Dr. DeLauer was the Chairman of the Board and Chief Executive Officer of Fairchild Space and Defense Corporation. In the early 1980's, Dr. DeLauer was the Under Secretary for Research and Engineering in the Department of Defense. His responsibilities in that capacity, included the Defense Systems Management College (DSMC). He was a strong advocate of acquisition education and greatly assisted in the growth and reputation of DSMC. The entire defense acquisition community shares his loss with his many friends and family.



ACKNOWLEDGEMENTS

The success of the conference resulted from the efforts of many people. Our grateful thanks to the presenters: Mr. Murrin, for his keynote address; to the panel members, Dr. LaBerge, Mr. Donnelly, Mr. Entin, Mr. Fletcher, Mr. Johnson, and Dr. Jackson; and to all the workshop leaders and coordinators whose names are given on the workshop listing page. A special thanks to Ms. Viani and Ms. Fowkes of DSMC, and Ms. Flaherty and Ms. Cahill of PMI whose work in preparing for the conference and the proceedings was invaluable.

Conference Co-Chairmen

Mr. Bill Clark, DSMC

Mr. Elvin Isgrig, PMI

Dr. Ben Rush, DSMC

Mr. Jim Woodford, OSD

The Defense Systems Management College (DSMC) was founded 20 years ago to develop a curricula and teach the art and science of program management. The College has educated thousands of mid-career and senior students from defense, allied defense organizations, and contributing industries. Students with diverse backgrounds study in integrated teams.

The curriculum embodies knowledge and skills essential to the management of research, development, manufacturing, procurement, acquisition, and logistical support. The lessons integrate the discrete disciplines common in the traditional curriculum. The perspective and techniques taught address short-term efforts within organizations with primary goals and objectives which are long-term.

The integrated Program Management Course (PMC) has nurtured a family of short courses. They are Finance/Funds, Contract Management, Performance Measurement, Manufacturing Management, Acquisition Management, Logistics, Software Acquisition, Multinational Program Management, Systems Engineering Management, Technical Managers Advanced Workshop, Test and Evaluation Management, and Total Quality Management.

The DSMC has developed about 30 publications and handbooks. For more information, contact:

Defense Systems Management College
Fort Belvoir, Virginia 22060-5426
(703) 664-1084

The Project Management Institute, a non-profit professional association, has grown in 20 years to an international force in the professions of project and program management. It offers members a Project Management Body of Knowledge (PMBOK), refereed journals, a certification program, local chapter structure, methods research, continuing education, and course concentration and degree program assistance and accreditation.

A major Seminar/Symposium of workshops, technical papers, book fair, and product/service exhibition is sponsored annually. Recent sites include San Francisco, Montreal, Atlanta and Calgary.

There are cooperative programs from time to time with the International Project Management Association, INTERNET. Regional seminars and conferences are sponsored by chapters and in collaboration with chapters of other associations.

An established certification program for "Project Management Professionals" is in place. Examinations are offered in conjunction with each annual conference, at regional locations at other times, and in support of associations in other countries. An education committee, with membership from the several industries and functional specialty areas of practice, address the subcommittees and handbooks.

The PMI publications and handbooks are available. For more information, contact:

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Drexel Hill, Pennsylvania 19026-3190
(215) 622-1796

CONFERENCE PROCEEDINGS

"Managing The Industrial Modernization Process"
April 5, 1990

TABLE OF CONTENTS

EXECUTIVE SUMMARY

On April 5, 1990, the Defense Systems Management College (DSMC) and the Project Management Institute (PMI) sponsored a conference for industry and government personnel to discuss managing the industrial modernization process. The goal was to identify and prioritize issues, and recommend ways to improve quality and productivity in the defense industrial base. The approach was to look at policy, practice, and education issues affecting industrial modernization. The participants successfully used this format to develop a number of recommendations which are provided in these proceedings.

The morning session provided the foundation to achieve the conference goal with a keynote address by the Deputy Secretary of Commerce, the Honorable Tom Murrin, and by panel presentations on policy and practice issues in industrial modernization. The afternoon session consisted of 10 workshops structured around major programs and practices in the management of industrial modernization. The workshop leaders concluded the day with brief summary presentations to attendees.

Presenters emphasized that industrial modernization will be a greater challenge in the '90s in light of a declining Department of Defense (DOD) budget. In this new environment, modernization must be more than new plant and equipment. In the '90s defense industry modernization will emphasize improved management of resources through continuous improvements to integrated manufacturing, engineering and business processes. The conference looked for the key issues from government and industry perspectives to improve these processes.

Workshops of this multifunctional conference addressed a broad cross-section of topic areas. These included program management, impact of tax policy, specific incentives for modernization, implementation of total quality management, use of commercial practices, and many others. While topic areas were diverse by necessity, it was enlightening and encouraging to see how products of the 10 workshops interrelated to provide the critical issues for modernization. The DOD and the defense industry are improving quality and productivity in this multifunctional approach.

This summary provides critical issues that integrate across the 10 workshops. These integrating issues structured around the three areas of policy, practice and education of modernization, are summarized in Figure 1. Following is a brief discussion of the 9 critical issues in the areas of policy, practice, and education. More detailed analysis of main issues can be found in workshop summaries and proceedings.

POLICY

1. Need for government to provide clear multi-service objectives and minimize disincentives.

The policy area, not surprisingly, was involved primarily with the appropriate role of government. The consensus was that the government role in modernization issues is to provide clearer objectives and to minimize the impediments of obtaining these objectives. The intent would be to have multi-service objectives which would prevent separate detail implementing instructions by individual services that divert the intent and delay implementation. Removing disincentives seemed to be more important than providing new incentives.

Figure 1

MANAGING THE INDUSTRIAL MODERNIZATION PROCESS

INTEGRATED FINDINGS AND RECOMENDATIONS OF THE WORKSHOPS

Policy

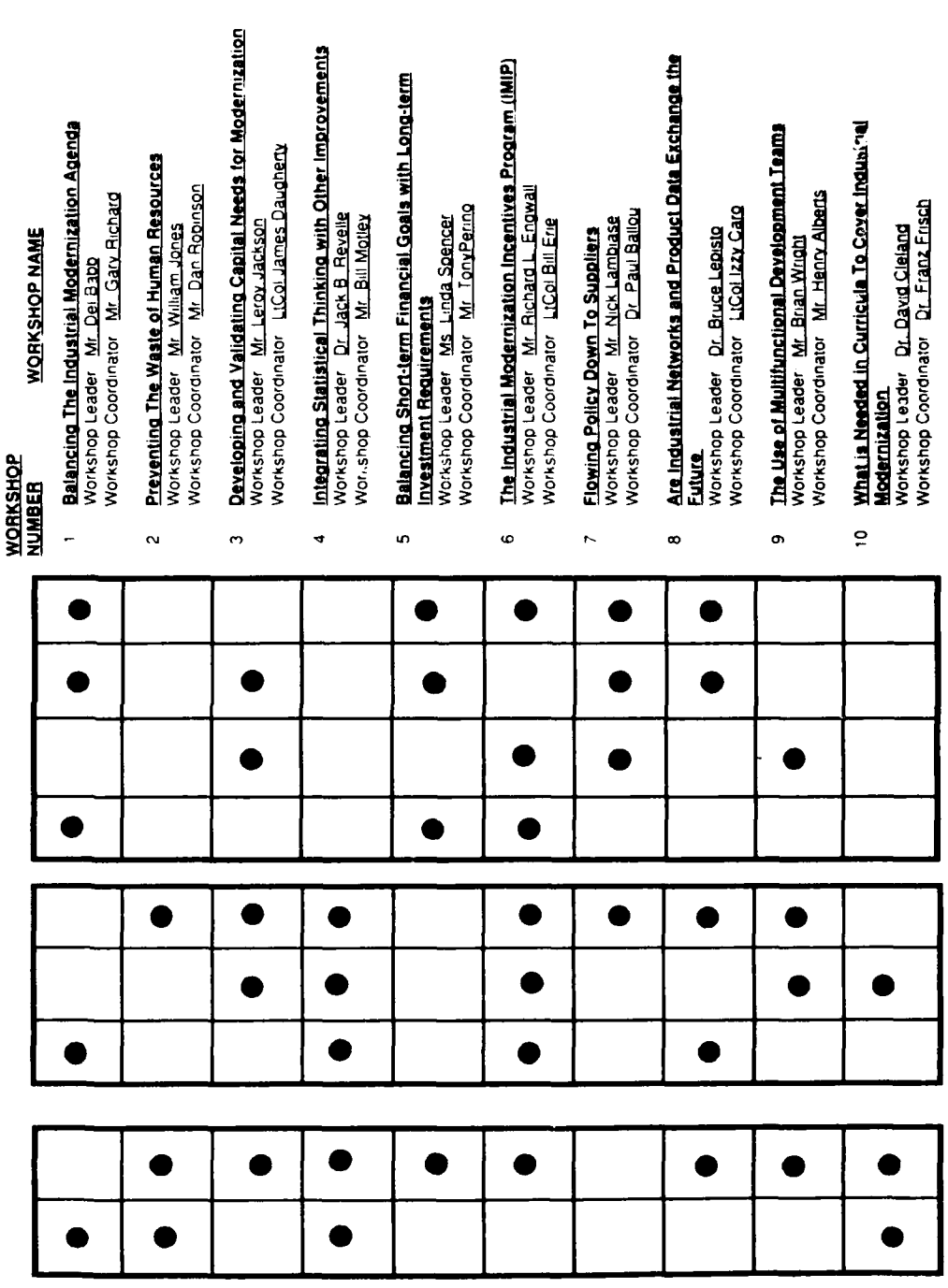
1. Need for government to provide clear multiservice objectives and minimize disencentives.
2. Need for integrated strategic planning for modernization with government and industry involved.
3. Need to develop selected specific incentives for investment.
4. Need for new more appropriate pricing strategies.

Practice

1. Need to emphasize the validation of new equipment requirements.
2. Need to focus on applying quantifiable measures to process capability and yield.
3. Need to emphasize past performance in source selection, rationalize specifications and promote commercial solutions.

Education

1. Need for better educated acquisition work force in government and industry.
2. Need for greater industry involvement with education and training at all levels.



2. Need for integrated strategic planning for modernization with government and industry involved.

Policy as it impacts needed planning for investment must be integrated between government and industry. Each company's annual investment planning process must be integrated with the Industrial Modernization Incentive Program (IMIP), Mantech, Independent Research and Development (IR&D), and prioritized program requirements planned by the government. The government must be sensitive to the risk that changing technical processes and fluctuating business bases have on industrial modernization. A DOD strategic acquisition plan that provides a meaningful baseline for long-range planning is required.

3. Need to develop specific incentives for investment.

While generally the tenor of recommendations for government involvement in the policy area was for less involvement, there was agreement on the need to develop certain specific incentives for investment. There was recognition of the importance of cost of capital in selecting viable investments. This means that tax policy changes, which would lower the cost of capital, would be a powerful force to increase investment. This area integrates tax policy with investment and profit policy and is broader than just the defense industry. Specific tax policy changes discussed were faster depreciation, favorable capital gains treatment, elimination of double taxation for corporations, and investment tax credits. Narrowing to the defense industry, incentive programs such as IMIP and Mantech are valuable incentive programs and are needed at all tiers. Government should work directly with subcontractors rather than relying on contractual flow down. An important incentive for contractors is to keep the data rights developed under these programs flowing and to have the ability to sell that data to other government contractors. In the IMIP program a strong product orientation has sometimes been dysfunctional and we need a greater focus on processes; this is in accordance with Total Quality Management (TQM) and will enable eliminating privity of contract problems when there is direct government involvement with subcontractors. Changes in the IMIP program, unlike changes to the tax policy,should be accomplished without the requirement for legislation.

4. Need for new more appropriate pricing strategies.

A recurrent theme in many workshops was the need for a new pricing strategy that could be used to replace cost-based pricing. The disincentives of using cost-based pricing was an important issue not only as a detriment to investment but as the root cause of inefficiencies in a number of our management systems. The suggestion of commercial pricing is a partial answer. A specific recommendation was made to lower the exemption for costing backup data for products with 55 percent commercial, to products with 35 percent commercial. This would cover a broader spectrum of products.

PRACTICE

1. Need to emphasize the validation of new equipment requirements.

An important conference theme was the recognition that modernization must be more than investment in new equipment. The need to validate the requirement for new equipment, and to maximize the utilization of the existing plant and equipment before taking on new investment, is in accordance with the principles of TQM and has been demonstrated as a critical ingredient to successful productivity turn-around situations. This ties in with the need to emphasize the role of

people management and to know the capability of the organization from a people perspective. This emphasizes the need for improved internal and external communications within our organizations to enable effective multifunctional efforts. The concept of product networks, where industry and government wide standards are used, is important to improve communications. Development and implementation of these standards must be by joint government-industry participation and not with government contractual requirements.

2. Need to focus on applying quantifiable measures to process capability and yield.

There is a need for simple measures of productivity. These must be quantifiable measures of the benefits of the success of modernization. In developing these measures, we need to improve the application of statistical based techniques. In several of the workshops, the importance of statistical techniques was emphasized and, while the techniques exist, effective application of these techniques is lacking. A primary concern is in the way cost-benefit analysis uses these techniques. We cannot spend more effort in validating our success than we save in the implementation. This has important implications in how the post-implementation aspects of IMIP are managed.

3. Need to emphasize past performance in source selection, rationalize specifications and promote commercial solutions.

There was extensive discussion in a number of the workshops regarding implementation of commercial solutions to things like source selection and pricing of products. A specific solution was to emphasize past performance in the source-selection process. Using past-performance is in accordance with the TQM approach of developing long term relationships with suppliers and selecting suppliers with quality processes.

EDUCATION

1. Need for better educated acquisition work force in government and industry.

Our best investment in people is education. Within the acquisition work force, now more than ever, quality education in the work force is critical. We need greater emphasis on joint DOD defense industry education in specific acquisition topics and policies affecting investments, such as IMIP. It is important that DOD and defense industry personnel learn and share these ideas in the same classroom. This applies not only to specific programs affecting investment but for the entire subject area of acquisition management. The DOD and defense industry personnel must be educated in the overall acquisition process and understand the program management functions that integrate across the disciplines. This is critical to success of multifunctional teams that ensure the optimum relationship between development and production. An area in the education environment needing greater emphasis is the application of statistical techniques. If statistical-based techniques are essential to optimizing process capability and improving yield, then the need for modernization improvements requires a greater understanding of statistical methods.

2. Need for greater industry involvement with education and training at all levels.

We have seen excellent examples of greater industry involvement with education and training at all levels. Companies in the defense industry have instituted large training programs to assist their employees in understanding their roles in a new more participative organization. These vary from understanding in detail how their individual job contributes to the return on investment

of the corporation; to providing the statistical education necessary to understand the new statistical process control techniques; and acquisition education for individuals involved in program management. An important part of industry involvement is assisting universities and colleges through cooperative education programs, and providing faculty and grants. Industry involvement to increase education needs to grow significantly at all levels within industry, with universities, and outreaching to the secondary system.

The executive summary is followed by a complete transcription of joint session activities and proceedings of each workshop. The workshop results are reported in transcriptions of summary presentations to all conference participants by each workshop leader at the close of the day. Also, a description of the individual workshop activities is provided in proceedings of each workshop.

MANAGING THE INDUSTRIAL MODERNIZATION PROCESS
THURSDAY, APRIL 5, 1990

CONFERENCE AGENDA

8:00 - 8:30 a.m.	Conference Registration - Building 226 Coffee and Danish - Seminar Room 1
8:30 - 8:40 a.m.	Conference Introduction Dr. Benjamin C. Rush - Conference Co-Chairman
8:40 - 8:50 a.m.	DSMC Welcome MG Lynn Stevens, USA Commandant Defense Systems Management College
8:50 - 9:25 a.m.	Keynote Address The Honorable Thomas J. Murrin Deputy Secretary of Commerce
9:25 - 9:40 a.m.	Break Coffee and Danish - Seminar Room 1 Telephones in Seminar Room 5
9:40 - 10:35 a.m.	Introduction by Col. Elvin Isgrig, USAF (Ret.) Conference Co-Chairman Policy Panel Members Dr. Walter LaBerge - Moderator Mr. Richard Donnelly Mr. Stephen Entin
10:35 - 11:30 a.m.	Practice Panel Mr. Brian Fletcher - Moderator Mr. Jack Johnson Dr. Richard Jackson
11:30 - 12:00 noon	Buses to Fort Belvoir Officers' Club for Lunch
12:00 - 12:55 p.m.	Lunch - Mount Vernon Room
12:55 - 1:25 p.m.	Luncheon Policy and Practice Panels - Question and Answer Session
1:30 - 2:00 p.m.	Buses to DSMC
2:00 - 4:15 p.m.	Workshop Activities Workshop Locations Shown on Workshop Page
4:30 - 5:30 p.m.	Workshop Summaries Panel of Workshop Leaders

1. Hon. Tom Murrin, Keynote Speaker
2. Hon. Tom Murrin and MG Stevens
3. Mr. Bill Clark, Conference Co-Chairman
4. Mr. Brian Wright, Workshop Leader
5. Members of the Head Table at lunch

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photographs by Richard Mattox

6. Mr. Ellsworth Peterson, in the Question and Answer Session at lunch
7. Mr. Dick Engwall, Workshop Leader
8. Dr. Walter LaBerge, Policy Guidance Panel Moderator
9. Members of Workshop on Balancing Modernization - Commercial and Government
10. Mr. Del Babb, Workshop Leader

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7.

photographs by Richard Mattox

WELCOMING REMARKS

MAJOR GENERAL LYNN H. STEVENS, USA
Commandant, Defense Systems Management College

I want to welcome you to the Defense Systems Management College. You are a cross section of government and industry, manufacturing and program management, senior executives, managers of specific activities, and academicians. This should provide a rich blend of views of problems we face to improve quality and productivity in a time of declining defense spending.

I want to recognize the Project Management Institute (I) for co-sponsoring this conference with the College. The PMI is an international professional association directed at the practice of project and program management and has a kinship to DSMC, where we focus on program management education within the Department of Defense. Many of our faculty and management are members of PMI and some PMI leaders served DSMC. Our joint efforts produced this conference.

We provided you reading, including a report on the state of the defense industrial base entitled, "Bolstering Defense Industrial Competitiveness," in which problems affecting American industry competitiveness are given. The defense industrial base covers a large segment of the U.S. industrial capability and is inseparable from the U.S. industrial base as a whole. As Deputy Secretary Donald J. Atwood said in a speech last fall, "America's security is only partly based on a strong program of defense. It is primarily based on a strong technology-based economy." Current events in Eastern Europe have made this clear. A nation's political influence is closely tied to its industrial competitiveness.

In an article in the read-ahead conference package, the Massachusetts Institute of Technology Commission on Industrial Productivity reported on a "bottom up" study of U.S. industrial performance. It observed six weaknesses hampering the ability of firms to adapt to a changing international business environment. They are outdated strategies, neglect of human resources, failure of cooperation, technological weaknesses in development and production, government and industry working at cross purposes and short time horizons. While the defense industry was not one of the specific industries studied, it seems these areas are just as applicable to defense industrial complex. We structured this conference to cover these areas.

John Naisbitt and Pat Aburdene in their book Megatrends 2000 predict a booming global economy for the '90s. The global shift from authoritarian regimes to democracy lays the political groundwork for economic growth. Democracy by far is the most successful context in which to nourish the individual entrepreneur, the most important force for economic growth. These democratic forces reduced the cold war tensions and will, if continued, result in significant reductions in defense spending by the United States. These reductions total $22.4 billion, according to the current defense budget submittal to the Congress, compared to the budget submitted last year. This will provide a major challenge to the defense industrial complex. How can we improve quality and productivity with a decreasing volume? This is the critical challenge for defense in the '90s.

The College has been involved actively in the Department of Defense total quality management initiative. We are a leader within DOD in the critical task of educating the acquisition workforce in the Total Quality Management (TQM) concepts. The problems of declining defense spending,

increases in cost and time to develop equipment, and the need for higher quality equipment require us to embrace TQM concepts. Total Quality Management integrates many facets of management. It provides focus for production engineering and the philosophy for major improvement to our management processes. It has been given a strong boost within DOD by my boss, Under Secretary of Defense (Acquisition) John Betti, and his predecessor Robert Costello. This conference will use TQM as an integral part of the philosophy and management processes needed to attack the defense industry challenges of the '90s.

The challenge is to improve quality and productivity while reducing excess capacity. This conference will identify policy issues in areas like government and industry cooperation, sharing industrial capacity between defense and commercial, and the impact of tax policy on investment. The practice of modernization will focus on maximizing productivity within existing hardware investment through total quality management. This will include experiences in downsizing, improving the use of people resources and taking advantage of new technologies. The importance of education in improving quality and productivity will be addressed from policy and practice points of view.

The challenge for participants in this conference is to integrate discussions with our outstanding speakers into meaningful development of issues and recommendations during the workshops. These issues and recommendations will be presented in conference proceedings and sent to each of you and to policymakers within DOD, the Commerce and Treasury Departments, and to the defense industry through the associations.

The keynoter for this conference, is an outstanding speaker, a long-time friend of the College - -The Honorable Thomas Murrin, Deputy Secretary of Commerce, who has a long and impressive career working with industry and government. He worked with the Westinghouse Electric Corporation for 36 years, retiring in 1987 after four years as President of the Westinghouse Energy and Advanced Technology Group. Secretary Murrin's career in manufacturing at Westinghouse spanned from manufacturing engineer to corporate vice president of manufacturing. He served the federal government as a delegate to the NATO industrial advisory group, member of the Defense Policy Advisory Committee on trade, member of the President's Commission on Industrial Competitiveness, and was First Chairman of the Board of Overseers for the Malcolm Baldrige National Quality Award and the Defense Manufacturing Board. He had a major involvement with higher education, and served as Distinguished Service Professor at Carnegie Mellon University, Member of the Board of Trustees of Fordham University and Chairman of the Board of Trustees for Duquesne University.

Ladies and gentlemen, it is my great pleasure to introduce the Deputy Secretary of Commerce Tom Murrin.

KEYNOTE SPEAKER

Remarks By
Thomas J. Murrin
Commerce Deputy Secretary

"Managing the Industrial Modernization Process"

Thank you, General Stevens. It is a pleasure and a privilege to take part in this conference.

Some of us here today have been speaking for years about the link between military and economic security. I came to expect the usual response to this assertion --- a polite nod of the head; polite agreement. But I was rarely convinced that my audience truly believed in the point I was making --- nor was I convinced that they understood its implications for our country.

That's rapidly changing. Many of our nation's political and industrial leaders have come to appreciate that our "national security" requires both military and economic security.

I think this group already knows that both Defense Secretary Cheney and Deputy Secretary Atwood appreciate the linkage --- and I can assure you that Commerce Secretary Mosbacher and I recognize how closely our military and economic goals are related.

Today I want to address one simple question --- which is both tough and complex to answer:

> What do we need to do in order to ensure that our defense industrial base is the best in the world?

This question can't be answered without looking at what is going on around the world regarding industrial competitiveness. And the globalization of industry is one crucial change that we must deal with.

During the past several decades, many American companies became multi-national --- with major operations in other countries. Their interests and allegiance, however, remained American.

Now we have truly international companies --- with international interests taking top priority. The consequences of these companies' decisions --- about plant location, hiring, R&D investments, and the like --- on U.S. citizens and on our industrial base seem of secondary importance to them. Put simply, it's sometimes hard to figure out what an American company is any more.

Markets are global to a degree only imagined a decade ago. To be successful, companies must develop and offer products saleable in the international marketplace. The competition is global, too, of course.

It is easy to focus on Japan, but the challenge comes from others also --- including South Korea and other Pacific Rim nations. The newly unifying Europeans should be thought of not just in terms of the size of their market --- but the likelihood that they will become stronger competitors with U.S. firms for domestic and foreign markets.

The prospect that the Europeans will link up with each other and with Japan is an added twist to global competition. Last month, Daimler-Benz of Germany and Mitsubishi of Japan announced that they were negotiating a plan for intensive cooperation in automotive technology, aerospace, microelectronics, and service industries.

U.S. organizations, in turn, are building up international alliances. For example, last week, United Technologies announced that it was joining Daimler-Benz to work on jet engines. Almost daily we read reports about new joint ventures involving U.S. and Japanese firms. In the midst of heightened trade-related differences, our governments are attempting to cooperate, also. For example, the N.Y. Times ran a front-page story last week headlined, "U.S. and Japan to Work Together on Weapons Systems Research."

As we consider the globalization of technologies and industries, it would be shortsighted to ignore the civilian and military technology potential of the Chinese, the East Europeans headed rapidly toward democracy, and the Soviets.

The reality of Soviet competition hit home for me recently when I welcomed a senior Soviet delegation visiting our Commerce Department to discuss a potential joint venture dealing with medical equipment. It turned out that the gentleman heading the delegation also was managing the Soviets' project to apply their impressive rocket systems --- built up during a chillier defense climate --- to the commercial launch business. They have in mind competing directly with our own young commercial launch sector by offering to launch communications satellites and other commercial payloads from Australia.

Don't get me wrong: there is much good that is coming --- and still more good that can be realized --- from such internationalization, and specifically, the globalization of markets and technologies.

This trend encourages sharing the financial burden of increasingly sophisticated and costly technologies and large projects --- including defense projects. It spurs the development of new emerging technologies and markets --- whether defense or civilian oriented.

But globalization also carries many risks. In the military arena, it makes it much more difficult to control sensitive technologies. It makes us inextricably dependent on other nations, and they on us.

In this vein, I don't believe that we can afford not to address directly the issue of our reliance on foreign sources of technology and products for both our civilian and military needs.
A new report on foreign vulnerability of critical industries prepared for DARPA by The Analytic Sciences Corporation effectively reviews our situation and sets out several options. I found most intriguing this report's historical perspective. The authors point out that our then-new American republic was forced to rely on foreign suppliers for essentially all munitions needed to sustain the Revolutionary War.

The study says:

> "Based on this experience, Alexander Hamilton's 1791 'Report on Manufactures' recommended the development of a domestic manufacturing base to ensure the U.S. a basic self-sufficiency in arms production and to avoid control by hostile European powers. Echoing this suggestion, Secretary of War Henry Knox sent a message to the Senate requesting funds to establish national armories. While conceding that domestically produced weapons might be more expensive than imports, he argued that the extra price was little to pay 'compared with the solid advantages that would result from extending and perfecting the means upon which our safety may ultimately depend.' "

So, clearly, balancing the need to compete and cooperate in an increasingly interdependent world with the requirement for a technologically strong and self-sufficient defense industrial base is one of the great challenges we face today.

Along with our many concerns about such recent developments, there also are encouraging signs for our industrial base.

First and foremost is the increasing attention these issues are receiving, and our growing understanding of the linkage between our economic and military security. The President's recent statements and actions regarding the competitiveness challenges facing our country are further evidence of our growing commitment to this issue. For instance, in a speech last month to the American Electronics Association, he expressed a commitment to work with industry in the

> "critical pre-competitive development stage where the basic discoveries are converted into generic technologies that support both our economic competitiveness and our national security."

The President also said that he supports legislation to reduce the antitrust uncertainty that may discourage joint production ventures.

These actions build upon the President's initiatives to reform the product liability system; to boost government support for R&D to new record heights; and to encourage productivity gains, savings, and long-term investment in high-tech industries by lowering the cost of capital.

With this perspective, I want to return to the basic question I raised earlier: What do we need to do in order to ensure that our defense industrial base is the best in the world?

Beyond the Administration initiatives I have mentioned, are the variety of defense management reforms that DOD is pushing at the highest levels. Those are sorely needed and welcome efforts.

There is more that we in government and my former colleagues in industry need to do if we are serious about the defense industrial base. Needed improvements that affect both our civilian and military competitiveness include:

: Making world-class manufacturing a top priority,

: Better educating and motivating our employees,

: More effectively applying advanced technologies, and

: Sustaining improved quality and productivity.

There are few secrets and no surprises in this short list. We know what needs to be done to improve the manufacturing component of our defense industrial base.

The sheer size of this base and the changing nature of our military challenges and new technologies mandate that we continually monitor and investigate our situation. But numerous studies conducted by DOD, its advisory committees, and private organizations have identified myriad problems and opportunities for improving the state of our defense industries and our overall readiness.

I recently chaired the Defense Manufacturing Board, which undertook its own studies. Mindful of previous efforts and analyses, our Board reviewed ongoing and planned DOD initiatives to address manufacturing-related issues. The Board also conducted several of its own analyses and recommended additional actions for DOD to consider. The newly reconstituted Defense Science Board is hopefully picking up where the Defense Manufacturing Board left off.

Let me review some of the basic manufacturing-related steps that I believe need to be taken to improve the capabilities of our defense systems.

Evidence is mounting that the time needed to develop high quality systems can be cut about in half --- while also dramatically reducing cost; tightening deployment time; and increasing the functionality of both simple components and complex systems. This can be achieved through the use of a variety of techniques which come under the umbrella of concurrent engineering.

Concurrent engineering strives for simultaneous development of both product and process technology. In fact, "concurrent management" is probably a more appropriate term, reflecting the full integration of R&D, design, manufacturing, marketing, and services functions.

Concurrent management can deliver the vital ingredients of products and systems in a highly competitive world marketplace
--- price, quality, flexibility, and speed-to-market.

This approach increasingly is being adopted by U.S. industry, which recognizes the advantages that others, especially the Japanese, are gaining by integrating these functions. DOD has begun to focus on using this technique in weapons projects at various stages. Still, we really don't yet have an adequate consensus on definitions for concurrent engineering, or concurrent management. We don't yet fully understand the barriers to their use by industry --- including government procurement and policy barriers.

Total quality management is a second basic need. DOD has placed a new emphasis on Total Quality Management and has committed to actions that will ensure that TQM policies and procedures are put in place. Former Secretary Carlucci's steps to implement TQM have been followed by strong statements of support by Deputy Defense Secretary Atwood and Under Secretary Betti. In fact, John Betti and I participated several weeks ago in an Office of Management and Budget-organized TQM advisory group meeting with public and private sector colleagues, and I was impressed with the Under Secretary's expertise and commitment to TQM. Preparing for today's session, I was pleased to note that the Defense Management Systems College here offers several courses on TQM.

We have a wonderful new standard for TQM. It is the Malcolm Baldrige National Quality Award.

Managed by our Commerce Department in close cooperation with the private sector, this award and the related education program offer a process of self-examination for TQM. Now in its third year, the program is helping companies and other organizations to achieve real quality improvement results. It sets out seven major criteria for quality improvement --- and provides a system for measuring how well companies meet the goal of TQM. If you are not yet aware of this program, and you haven't reviewed the award application --- which doubles as a practical guide to quality improvement --- I urge you to contact Commerce's National Institute of Standards and Technology. More than 75,000 of these guidelines have been distributed this year already, and thousands of organizations are benefitting by building quality into their organizations' strategic plans.

I asserted earlier that our military base depends by definition on our industrial base. Deputy Secretary Don Atwood put his finger on the issue when he said,

"The Department's interest in defense is inseparable from its interest in the U.S. industrial base as a whole. They are one and the same. Said differently, America's security is only partly based on a strong program of defense. It is primarily based on a strong, technology-based economy."

Recognizing this, DOD can take several important steps. First, the Department can become a world-class customer to elevate the performance of the tremendous defense contractor base. DOD purchases account for more than 10 percent of the manufacturing gross national product in this country. This is a powerful lever that can contribute not only to our defense industrial base, but to other portions of America's manufacturing sector.

DOD also can be a powerful stimulus for modernizing our industrial base through its manufacturing technology program, MANTECH, its Industrial Modernization Incentives Program, or IMIP, and its involvement in a whole range of critical technolgies.

The commercial-defense industry manufacturing linkage comes through loud and clear when you review the second Annual Defense Critical Technologies Plan, just released. Put together by DOD and the Department of Energy, this document identifies the 20 technologies considered to be most critical to ensuring the long-term superiority of U.S. weapon systems. For each technology, the report sets out plans and milestones, industrial base and manufacturing issues, and an assessment of the positions of the Soviet Union, NATO, Japan, and other industrialized countries. The report provides further welcome evidence that manufacturing considerations are receiving more weight within DOD.

Education is another one of those basic areas where our nation needs to make quick and substantial progress. President Bush and the country's governors have drawn much needed attention to the critical importance of education to our nation's future, and some basic goals have been set. Nowhere is our need more obvious than in our defense industrial base, which depends upon a skilled, thoughtful, and capable workforce of dedicated men and women to use the latest manufacturing techniques to produce top-quality weapons systems and supplies at the lowest possible cost. DOD officials, in fact, have spotlighted the Department's role in education during the past year.

The Defense Systems Management College is a vital part of that expanded effort. General Stevens, I applaud your efforts and those of your colleagues here --- and urge you to do even more, especially in emphasizing manufacturing technology and management in your programs. DOD can, for example, improve our manufacturing capabilities by giving strong consideration to encouraging recipients of the approximately 20,000 DOD-financed college scholarships to take up manufacturing-related studies and to pursue manufacturing careers.

Before I close, I want to take note of the very promising trend of greater cooperation --- among industrial organizations, between industry and government, and between government agencies like DOD and Commerce. In this latter category, I place the Interagency Working Group on Advanced Manufacturing, involving DOD, Commerce, NASA, the U.S. Trade Representative's Office, and several other agencies. This committee, which I now chair, provides all federal agencies which have an interest in the industrial base a forum to cooperatively find ways to encourage industry to adopt advanced manufacturing technologies. The group was formed largely to address the business issues that affect the adoption of advanced manufacturing --- recognizing that we have made major progress in the technology of manufacturing but that we face institutional barriers to its effective use. These include ways to ensure that corporate management systems more adequately justify investments in automation and quality, and ways to encourage incorporation of design for manufacturability and concurrent engineering and manufacturing.

Overall, I am encouraged by our growing recognition of the need to modernize and strengthen our industrial base. We can, and we must, do even more.

Thank You! Good Luck! God Bless!

Panel Members' Presentations

MANAGING THE INDUSTRIAL PROGRESS

POLICY PANEL

DR. WALTER LABERGE, Acquisition Policy Chair, DSMC, moderator. His background includes Senior Vice President Lockheed Corporation, Under Secretary Department of Defense, and Assistant Secretary of Army. He will share the influences of international competitive pressures, the economic environment for DoD contractors, and his outlook for future investment.

MR. RICHARD DONNELLY, Assistant Deputy Under Secretary of Defense (Manufacturing & Industrial Policy) is responsible for the Manufacturing Technology and Industrial Modernization Programs, and the Office of Industrial Base Assessment. He will share the DoD thrust for encouraging a more productive industrial base.

MR. STEPHEN ENTIN, Senior Resident Scholar, Institute for Research on the Economics of Taxation, formerly Deputy Assistant Secretary of the Treasury - Economic Policy will summarize the trends in tax policy and their impact on investment.

POLICY PANEL

Presentation by Dr. Walter LaBerge - Moderator

Good Morning! Because there are many military folks here and because of DSMC sponsorship, I will spend 10-15 minutes concentrating on defense industrial base development. Dick Donnelly will respond to questions on how to proceed with that problem, expanding to the national industrial base. Steve Entin will present a global look, being less concerned with the immediate defense problem. I will give my qualifications for this presentation.

I was the principal planner for Lockheed and charted their future. I retired with one major planning job left. I built a house on the Pacific Ocean with a beautiful view. Unfortunately, it was four and one half kilometers from the center of the recent 7.1 earthquake. If you say I am a "qualified planner," in my case, I was a lousy one. Nevertheless, I contend that most of us look at the industrial base as complicated. Tom Murrin would say in some respects our response is slow. Probably, many of us would say the problems of the world are changing faster than bureaucracy's ability to respond. In the Defense Department, there are only two problems of consequence--finding some industries willing to borrow money for a modern, contemporary industrial plant, and finding lenders. If you can solve these two problems, you are a success. Things going on that Tom talked about presume somebody was willing to invest and willing to lend. Let me address the issue currently preventing people from doing that. May I have the first slide, please:

SLIDE #1 (NOTE 1)

We conduct our business as shown here. If you look at top defense contractors and compare their debts between 1984-88, we doubled companies' debts. That debt resides largely in facilities which will not be well used. So you have debt, which presumes there will be loading of plants in the recovery of that debt through the overhead, now facing the issue of how we pay that debt--much less borrow more money. The next slide: This will be when high debt will restrict money lending.

SLIDE #2

This one shows profitability that could be used to pay that debt is reduced substantially. Now one can argue on whether the absolute numbers are right; but, I believe trend information is more believable. This slide shows the doubling of debt and the reduction by almost 40% of profitability. The line drawn horizontally is the cost of borrowing money. The cost exceeds by 2-3 percent the return you can expect to get from borrowed money. Borrowing money or lending it to someone with that kind of future is risky. Without changing that trend, all the talk about how to invest is specious.

SLIDE #3

The trend again is wrong. If you see how borrowing has increased in more than 4 years, and the way earnings growth increased, you see (using the Reagan years of lots of business) a negative trend. The next slide:

NOTE 1: Slides are provided at the end of narrative transcription

SLIDE #4

From whom do you get the money? There are two money sources to build an industrial base--one is selling company stock. This slide shows that, basically, people who give advice on how to spend money show a chart saying the worth of a stock's price-earnings ratio is lower for defense industries than for Standard & Poor's 400. The other place you can borrow money is the bank. Unfortunately, banks get the same information as stockholders and raise the interest rate. All major aerospace companies now face higher interest rates above the prime than before. So your two principal lenders are making it almost impossible to get money. The next slide:

SLIDE #5

Those were the good times; now the bad times. Essentially, what this slide asks is: "What will you really see in the future?" We don't need an advocate in Washington. With less contract money, one is going to have more contracts bid to survive. The system is driving itself to be more unprofitable. I conclude we will get more short-term in our survival response and less interested in the long-term, whether technological investment or facilities investment, etc.

I learned two things from the earthquake--have insurance and good building codes are important. The next slides show "building codes" I would use to survive with a reasonable defense industrial base.

SLIDE #6

There are probably two or three things that are important. First, get some incentive for investment in long-term facilities by writing them off faster and stop competition where it is only used to scare production facilities investors. Second, recognize that a decreased budget won't permit a unique defense industrial base. We must use, as much as possible, the commercial base that we will stress today. Therefore we must convince the Joint Chiefs of Staff Joint Requirements Oversight Council (JROCs) to agree that one of the most important things we want is that the system can be built on commercial tooling. Until we do, I believe we have an impossible task. Lastly, we need overseas sales because they are important to building--to make the business but not to invest in.

SLIDE #7

The next slide shows building codes for R&D. You should pay more for creative engineering associated with front-end business than we pay for the back-end execution. We pay, maybe, 1-2 percent more. That will not induce anybody to come to us when there is elsewhere. However, I think DoD has the wrong position regarding intellectual property rights. Inventors want to make money. Inventors can get industrial rights. They should be compensated commensurate with other industries. We can't expect people to give creative efforts to the government. They will offer it to private industry. May I have the next slide:

SLIDE #8

I believe we should be willing to say, "I'll take care of all the "eaches", if you tell me that my objective is for my best contractors to try to do as well, in terms of return, as the people that they sell to in the commercial world." Give someone the leeway to say, "adjust it anyway you want, but make the criteria that it is as reasonable to invest in the government world as it is in the civilian

world." I argue that these two issues are the primary ones--who will risk their money and who will lend it. Until you fix that, there are some interesting philosophical discussions on how to make a good system; but, you won't have a system to make good unless you solve those two problems.

Slide #1

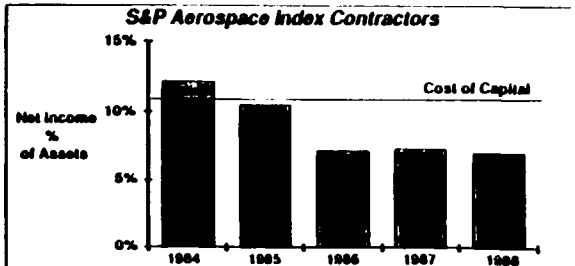
Debt

External financing of cash requirements almost doubled debt

Source. Annual Reports

Slide #2

Profitability

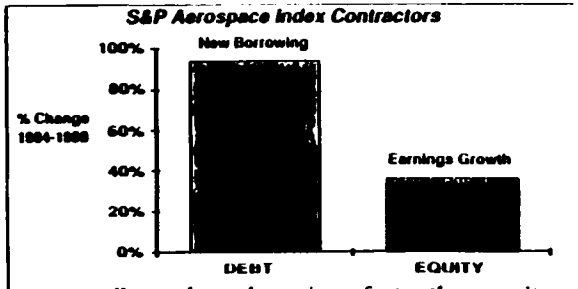


Below the cost of capital

Source. Defense Segment Data from Annual Reports

Slide #3

Debt

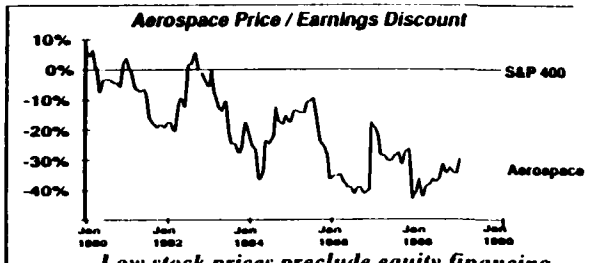


Grew about three times faster than equity

Source. Annual Reports

Slide #4

Stock Prices



Low stock prices preclude equity financing, forcing companies to borrow

Source: Standard & Poor's

Slide #5

prognosis for the defense industrial base

- as acquisition dollars go down, intensity of competition among contractors will go up
- with survival at stake, contractors will bid unrealistic performance, schedule and fees
- less business base and lower fees will exacerbate an already "bad business" perception by the investment community, with resulting lowered stock prices and bond ratings
- leading to both unwillingness as well as inability to invest in technology and modern facilities
- what ever residual investment money is available will go to proposals and short term new business

Slide #6

"building code" suggestions facilitization for production

- make special facilitization investments attractive to industry - by getting Congress to substantially increase amortization rate and DOD to resist insisting on uneconomic dual sourcing
- focus on "dual use manufacturing" as a way for DOD to leverage on more rapid industry modernization - to the extent, if necessary, of reducing performance
- actively encourage US contractors in their efforts for "line filler" over-seas sales of military products

Slide #7

additional "building codes" R & D

- reduce proposal costs by establishing contract allowable limits for proposals, allowing IR&D to be emphasized in contract allowable costs
- strengthen rather than attack industry intellectual property rights. in return, obtain rights for use after equitable payment of worth
- emphasize real "dual use" US component technology so incentive to invest multiplied by civilian applications
- augment R&D fee structure, cash flow provisions, and reduced paper work to encourage start-ups to wish to do business with DOD

Slide #8

additional "building codes" adjust industry base to S&P 400 average

- "plan the DOD business so that, on the average, its surviving industrial base achieves rates of return on investment equivalent to the returns of the Standard and Poors' 400 companies"
- adjust vendor selection criteria, fee structure, cash management potential, preferred supplier arrangements, etc. to accomplish the above.

POLICY PANEL

Presentation by Mr. Richard Donnelly

It is a pleasure to be here this morning to participate in this conference, and I am very happy to see people from so many backgrounds here today to discuss this important issue of MANAGING THE INDUSTRIAL MODERNIZATION PROCESS. The title for this conference concisely describes one of the most significant dilemmas we face in this country today. The complexity and diversity of the issues surrounding the Industrial Modernization process have so many variables and constraints that it is impossible to provide an exact solution for each of your circumstances. We must be very careful to recognize the profit motive of industry and understand the government's role as a motivator as well as a customer. Each of us will have to go about modernization in a different environment, however there are many similarities of objectives and obstacles that each of us share.

Industrial Modernization is a complex set of actions requiring the coordinated effort of many interrelated activities. Modernization is not a single point activity that can be assigned to an individual or a group and forgotten. It is a team sport requiring attention of top management, marketing, finance, engineering, and of course, manufacturing personnel. As a team sport, each position is significant and all players will not have their hand on the ball at any one time. IMIP is one member of that team. I can assure you that we are ready to make the changes necessary to allow the team to proceed in today's environment.

I believe the most appropriate place to engage the corporate team players in a coordinated effort to modernize their operations is in the strategic planning effort that they tell me all "well managed" companies have (in some form or another.)

Before I talk about contractor strategic planning, I would like to share with you some strategic planning we have been doing ourselves.

First; organization. Under the last administration, I was the Assistant Deputy Under Secretary for Manufacturing and Industrial Programs and the Industrial Modernization Incentives Program (IMIP) responsibilities were moved to my office. This was done to bring Manufacturing Technology (ManTech) and IMIP back under the same organization. Recently, however, we have made some additional changes putting us back into the Office of the Assistant Secretary for Production and Logistics. There is more change to come which will improve OSD's focus on production and manufacturing.

As we have our organizational situations, each contractor has a unique organization and unique situations that must be overcome to accomplish the goals of the company. Modernization is but one of the activities that must be planned to make your company competitive and successful.

Second; the relationship between ManTech and IMIP. The strategy which put IMIP and ManTech back into the same office has worked, as I believe ManTech and IMIP are now better equipped to manage the development and implementation of technology than before. In my corporate plan, I have adopted the perspective that the Industrial Modernization Incentives Program is one of the customers of ManTech, and as a good customer, IMIP will utilize the data products of ManTech and provide feedback. One such feedback will be the identification of technology (or process technology) voids needing ManTech assistance. The intent of this feedback is to identify projects

that would be implemented in many places, once the technology was available. IMIP's focus will continue to be on the implementation of appropriate technology with the understanding that it is a corporate decision to make these investments with corporate funds. The source of that technology may be ManTech, or it may be the application of off the shelf items in use throughout industry. More on that later.

Third; modernizing the Modernization Program. Many of you attended the ManTech/IMIP conference last December where Deputy Secretary of Defense, Donald J. Atwood, said, referring to IMIP:

> Unfortunately, implementing this program has become cumbersome. One measure that would help correct this would be to accept cost estimates prepared in a manner consistent with those used in major weapon system development, thus eliminating the extensive resources now consumed in validating estimated cost savings.
>
> Streamlining IMIP to foster greater contractor participation is important because its benefits are tremendous.

I'm sure that many of the ideas that surface in today's workshops will help me do that.

We have an action underway at this time rewriting the Defense Directive for the Industrial Modernization Incentives Program. (DoDD 5000.44) This directive is one that survived the recent review, and will be kept as a stand alone directive. We were directed in a Defense Management Review report (The Joint OSD-DoD Component Regulatory Relief Task Force Report) to rewrite and reissue this directive. There are several policy changes planned including the one Mr Atwood suggested.

First: the objective of IMIP will be restated to focus on the benefit to the country obtained through modernization of the national industrial base. The Defense Industrial Base, being a part of the larger national industrial base, will be the focus of our Defense effort. Investments in industry, by industry, will be the primary measure of the success of the program. The principal objective of the program is to motivate the contractor to make investments in modernization projects that are beneficial to the company and to the government. The decision to invest will be a company decision, and the decision to offer IMIP incentives will be a government decision. Our job is to manage this to the mutual benefit of both parties.

The refocus on investment is necessary because the present focus on savings creates several activities that frequently do not add value to your operation. The elimination of extraneous accounting activity established solely to validate savings does not imply that we don't expect there to be productivity improvement inherent in modernization. We must recognize the profit motive and give the company decision making process credit for being able to direct the available capital to the area that will have the best total payout. Short term benefits can not be a requirement in a long term modernization effort.

At a recent American Electronics Association Luncheon, President Bush said:

> We believe that one of the most crucial Federal priorities is to encourage planning for the long term -- because, for too long, where investment is concerned, the Federal government has been more of a hindrance than a help.

To further the removal of the hindrance IMIP may have presented in the past, and to follow through with the statement Mr. Atwood made, the new policy will prescribe the use of estimates in projecting potential benefit of a modernization project, and for the negotiation of an appropriate incentive.

Historically, IMIP has focussed on "factory-wide-modernization." We would like to encourage total modernization wherever possible, however we recognize that there are many opportunities to make improvements on a far smaller scale. Present policy requirements result in a lot of studies and plant surveys being conducted regardless of the anticipated project. There are modernization objectives, such as a "factory-wide" modernization, that require the in depth study, however most of the modernization that we envision in the sub-contractor and lower tiers does not require a detailed total factory analysis. The rigid requirement for the analysis will be eliminated and reliance on company generated analysis will be used whenever possible.

One of the pitfalls of the IMIP process has been the lack of follow-through on many of the projects. I believe there are three cases that we must address:

> First: the return-on-investment of the project was determined to be sufficient to motivate the contractor to continue the project on their own, so they did. Their IMIP activity may have ceased, but their modernization objective was completed. I think this is a viable part of IMIP as a motivator.
>
> Second: the pain of proceeding with the IMIP requirements was greater than the company could tolerate, and all activity ceased. We are going to take as much of the pain out of the process as we can in hopes of getting as much modernization as companies can justify.
>
> And third: the "modernization plan" was not adequately integrated into the company or corporate strategic plan, and the business plan, to allow execution. Excessive study and analysis did not result in integration, and too often resulted in another proposal to do another analysis.

To address these follow-through issues, the policy will require the Services to measure the follow-through of their projects in an aggregate ratio similar to a batting average. When we have to make tough decisions, we will be checking the amount of investments made and the completion average.

To reduce the risk of modernization not being in concert with the company team objectives, the new policy will require that the company strategic plan contain modernization planning and the modernization project be consistent with that plan and the business plan. For some companies, IMIP may become the catalyst that motivates them to develop a formal strategic plan. This requirement will not address the style or format of a company's strategic plan, only that it will have one, and modernization planning must be a part of it. Remember that these plans are not cast in concrete, and as the company obtains feedback from many sources, it will be adjusting its strategic plan, and adjustments may also be necessary in their modernization plans. Our policy and more importantly, the implementation of that policy, will be flexible enough to accommodate strategic decisions made by the company.

Another facet of the new policy will be a reflection of the past few years effort and the direction of the future effort in the area of lower tier suppliers. The majority of our budget dollars will be targeted at the subcontractor or lower tier levels. The IMIP contractual methodology and reward

payments will be available at all levels, however the seed funding will be used primarily for the smaller firms. There may also be some teaming with existing state and local efforts to help industry help itself. We hope to be able to provide sufficient flexibility to enable the Services to identify areas of need, and allow them to seek innovative ways to accomplish the objective of motivating industry to modernize.

The last area that I would like address is the source of technologies implemented in your modernization efforts. One of IMIP's greatest challenges is to assure that existing technology information is sought and made available. ManTech data sets are a prime example of one of the sources of technology information available to the defense firm. Other IMIP project experience is another. There are many other outside sources including the prime contractor the small firm sells to.

The technology chosen to accomplish a task may vary from firm to firm, depending on their view of their future business, and on the capital available for modernization projects. None of us have the capital to invest in all of the projects that we would like to do. The use of new technology is not a requirement, and may not be desirable in many small firm situations. New equipment is not a requirement, either.

I would like to congratulate the program sponsors for their effort to recognize that all modernization efforts are not high dollar investments with new state of the art equipment. The workshop scheduled for this afternoon led by Mr Jackson will explore some strategies used to improve operations using existing equipment, just managed differently. Many of us would benefit from close examination of the way we do things, and if there is a way to improve our operations, we should make every effort to implement that improvement. I will be interested in seeing the output of that workshop.

To summarize, the policy being developed for the modernized Modernization program will focus on motivating industry to help themselves and the country's competitive position with the benefit to the government kept in proper perspective. The numbers of projects and the follow-through to completion will be the measures, and the demands for surveys and extraneous accounting systems will be eliminated. The use of estimates of the same calibre as major weapon system proposals will reduce the hindrance that President Bush was talking about.

I urge you to make your opinions known at this afternoon's workshops. We will be using the output of this afternoon's workshops to help us evaluate the effectiveness of our new policy directive prior to submitting it for coordination. We will consider all recommendations from the workshops for inclusion in this policy or future implementation guidelines. Thank you for your help in this effort, and I would like to thank the Defense Systems Management College for making this event possible.

POLICY PANEL

Presentation by Mr. Steve Entin

It is pleasure to be with you. I am in the private sector now so I don't have the staff to type me up a speech in big letters; but I will try to make due with these notes. When I was at Treasury I was involved with thirty interagency working groups. Among them were several that had DoD participation including the privatization of space launch capabilities, intellectual property rights in R & D, semiconductors and a number of others. It is really a great pleasure to be back and doing this sort of thing again. I think that this is a particularly effective type of forum. There are only two things inevitable in the world: death and taxes and here today we are discussing taxes in a military setting. Ben Rush asked me to speak on "Trends in U.S. Tax Policy". Now my first reaction was that I was being asked to make order out of chaos as the Lord did on day one. A trend in tax policy! Well, fortunately, there is a new book out entitled, "Chaos" which describes the efforts of meteorologists, mathematicians and physicists to find underlying patterns in seemingly random events. They are achieving some success so with their efforts before me, I have plunged in to see if I could find some hidden patterns behind tax policy. I believe I have and they are not particularly encouraging. Now I put a great stress on the ability of bad tax policy and other government programs to mess up an economy. I don't think anything else is large enough really to mess up an economy. And I tend to focus for a second and third on tax policy. I focus eighth through twelfth on claims that Americans are shortsighted, shallow, lazy, quarrelsome and materialistic. Factors four through seven involve technological breakthroughs, weather, earthquakes and sunspots.

Let me put a couple of things in perspective. The American economy and the American people are doing quite well, thank you very much. And I hope we don't get put down too badly versus other people in the world. We are innovative and as hardworking as you can find anywhere. The fact is that there has been no decline in manufacturing in the postwar period as a share of GNP. Now we do have less job growth in manufacturing than in the service section. Productivity advances in manufacturing have certainly enabled us to produce more goods in the manufacturing sector with fewer workers relative to the labor force. And, indeed, as we have gotten richer, people have spent more money on services. So it is partly due to productivity trends and preferences. It is also due, in part I feel, to large shift in the tax burden on to capital formation and saving in recent years. And I think that is something we ought to take a hard look at because I think if we had a more neutral tax code we would not have seen quite the shift in output that we have seen.

Let me give you a very brief bit of background on the budget picture. One trend you can see in taxes, I think, is that they are up. If you look at the projections for tax revenue in the FY 91 budget for the 1990-1995 period, you find taxes at 19.6% of GNP. The 1950-1979 average was 18%. Only twice have we had taxes in the 19 and 1/2 to 20 plus range. That was, in one case, the Vietnam surtax in 1969 and 1970 which coincided with that recession. And at the end of the 1970's when inflation had pushed everyone up through the bracket structure, we had by 1981 and 1982 taxes in the neighborhood of 20% of GNP and we had a roughly three year recession - 1980-1982 in that same time frame. Outlays since the mid-1970's are way above average. Average outlays as a share of GNP have been 19.2%. Between 1980-1989 they were between 22 and 24% of GNP. They are on their way back down partly because we have done some spending restraint, not that we have had real cuts everywhere but we have had a slow down of spending growth and the economy has spurted and caught up somewhat with the outlays. Note though that taxes at

19.6% of GNP are above the long range historical trends of outlays of 19.2% of GNP. We don't have a budget deficit because we have taxed too little.

It is not just the level of taxes though that matter; it is where they are placed and how they are structured. I think one thing we learned in the 1970's with its burst of inflation is that you have to pay attention to the type of taxes that you are enacting. In the O'Casin model it did not matter. If you took a dollar in but you spent it you, in a sense, recirculated the money and everything was fine. You can carry that to its logical conclusion - you can put tax rates up to 92% on individuals and claim that as long as you spend the money everything is fine; but at 92% which was at one point thc top tax rate, people don't work as hard; they don't save as much. If they do save, they save it in tax shelters, not in ordinary investment. When the Kennedy tax bill cut the top rate from then 91% down to 70%, revenues in those brackets went up sharply. People suddenly began declaring income again. So it makes a great deal of difference what you do. That was the lesson of the 70's brought on by the high inflation which showed us how the tax code worked if we weren't paying attention to it. In the 1970's after all that inflation, we had taxpayers who used to be in the 17% bracket, the average family, pushed up to the 22% to 24% bracket. We had people in the 24% bracket pushed up to the 40% bracket. The individual side had been totally destroyed in its structure but the bracket creep from the unindexed tax code. And we had major strikes in the 1970's on the issue of overtime. Workers did not want it - they wanted nontaxable fringe benefits. Ford, International Harvester, all had horrible problems in the 1970's because of such things. The saving rate fell. On the business side, we had equal trouble with inflation. You write you plant equipment off over a period of time. If inflation is eroding the value of the write-off, you do not end up writing off the full cost of you capital. The after tax cost of plant equipment rises sharply. By the end of the 70's investment had fallen so far behind work force growth, that productivity was actually falling, not since the depression, and real wages were falling.

Now that set the stage for the 1981 tax changes. These were not the first good tax changes we had done from the point of view of capital formation. There has been others in the past. In the first place, we did have the Kennedy tax cuts which lowered the rate structure. There is a handout which I put on the back table with a chart on the front and a list of tax bills following. The Kennedy cuts lowered the tax structure from a range of 20% at the bottom and 91% at the top down to a range of 14% to 70% and that top rate came down on wages and salaries to 50% in the 1969 tax cut. The Reagan cuts lowered the range to 11% to 50% and the reason tax reform set three brackets with many of the very lowest brackets going to 0% and other brackets being 15%, 28% and a funny, little surtax that raises the 15% bracket to 28% flat rate on all income over a period of income and then falls back to the 28% rate; so that you end up paying 28% on your total income after deductions. That rate structure is much more conducive to saving and work effort and, indeed, has had a profound effect on lowering labor costs.

Under bracket creep in the 70's, General Motors had to pay $1.73 to give a worker a $1.00 raise to keep up with the cos: of living. The extra $.70 was the higher tax rate into which the worker spilled, raising the total tax burden on the worker. Now with the firm's sales prices only going up by let's say 10% and the tax liability on the worker going up by 17%, you see a 7% conflict between labor and management. What you have is the government sitting up in the tree dropping pebbles on the two sleeping giants until they get up and start fighting. It is a cute game. What was less cute was that government taking this added tax revenue, spending half of it, giving about half back in a tax cut - a fraction of which went back to reducing taxes on individuals but not lowering the tax rates. So they gave a little out here in a personal exemption or a standard

deduction, but the rates structure was still punitive and the rest was given back for special favors to special interests which, of course, keeps the finance and ways and means committee in business. So the damage was never corrected.

In 1981 we have the third major change in depreciation arrangements. There was a good improvement in class lives in 1961, there was a good improvement to asset depreciation range - a quicker write-off of plant equipment in 1971. In 1981 we had ACRS. ACRS gave people a faster write-off for most plant equipment; it gave an expanded investment tax credit which had come in the early 1960's and was then off and then on and off and then on - you want to talk about chaos. But that was enlarged and expanded. Declining balances were stepped up in stages from 150% declining balance in 1981 to projected 175% in 1985 and 200% declining balance in 1986. If you had kept the 1981 tax code and we had gotten to 1986 when it was fully phased in, we would have had virtually the equivalence between write-offs and the investment tax credit of first year write-off for expensing a plant and equipment. Now that is the economic norm. The income tax basically double taxes saving and investment. If you earn money and pay your tax on it and consume it, there is no further tax after the initial income tax. If you earn money and pay your tax on it and buy capital goods, the earnings of the capital goods are taxed again or the earnings on a bond or savings account are taxed again. And those earnings in present value equal the principle that you put in; so that it is equivalent to taxing that principle twice - the income tax in its ordinary functioning, taxes, saving and investment twice. You are allowed to write off your plant equipment purchase so it is to that degree exempt from tax but that is strung out over so many years that you don't write it all off. And for personal savings you do not get any deduction for income earned at that point or did not before 1981 unless you were in a private pension plan of a certain nature. We did get IRA's instituted (Individual Retirement Accounts) in 1981 which partially allowed you to deduct your saving but there were caps on that and, of course, there was a severe curtailment of them in 1986. We did not keep the 1981 tax code.

The recession, the higher budget deficits and so forth, and Congress' unwillingness to make amends in other parts of the budget lead to the 1982 tax bill which repealed over 80% of the cut in cost of capital for equipment which had been enacted the year before. We never got to the step-ups in the depreciation - the write-off rate. They repealed safe harbor leasing which would have addressed one of the main problems that Dr. LaBerge mentioned which is how do you get a company which has been burdened by obsolete equipment into a new field without having the drag from the overhang left over from the earlier investments that were not paying off. Safe harbor leasing addressed that. That was repealed in 1982.

In 1984 the Deficit Reduction Act, which Congress spent every penny of by the way of the next budget, took back about a third of the cut on the cost of capital on structures that had been enacted in 1981. Tax reform while lowering the personal rates and simplifying the personal side of the code paid for this in the supposedly revenue neutral way by further raising the cost of capital, lengthening depreciation lives, and not fully offsetting this with corporate rate reductions and other changes.

The next effect of the 1986 bill on the corporate or business side was to raise the cost of capital further back above 1980 levels before the whole mess started. On the personal side we curtailed the IRA's which was another major error and we have also curtailed contributions to tax exempt pension plans. So the whole shift as I see it is toward a generally better treatment of personal income as far as the rate structure is concerned over the last 30-some years since the Kennedy tax cuts. And in the first part of the period between the early 60's and 1981 tax bill, a more favorable

treatment of investment and plant equipment followed in the 80's by an unwillingness to control the outlay side of the budget and a gradual repeal of the incentives for capital formation such as the cost of capital has moved back up to the point where investment and plant equipment has been discouraged sharply. So the boom in investment that we did see in the beginning of the 80's has certainly tapered off.

In 1986 the Office of Economic Policy of the Treasury was pushing very hard for a back ended kind of equivalence to expensing in the 1986 tax reformat. We wanted depreciation write-offs to be sufficiently generous in the out years such that, in terms of present value, it would be equivalent to the first year write-off. By stretching the allowance out but in effect sort of paying interest on them we would defer the cost until the budget was in better shape but give people all the incentive to invest. The IRS with its accountants and the Office of Tax Analysis with its tax attorneys had come out of firms where the main investment was in human capital and they saw only the need to cut corporate rate. They did not see why plant equipment was particularly important to a company and they went with the plan that we have today. Only the Commerce Department and the Council of Economic Advisors protested that if investment were the goal you need to focus on the depreciation of the capital cost recovery allowances. We did not hear anything from the Defense Department suggesting that this might hurt the industrial base or the defense industrial base. We could have used an ally at that time. Had we been a little more savvy on how government works we might have gone fishing for an alliance but, as good little team players at the Treasury, we did not and worked within the system and got what you usually get when you work within the system. I would urge the Department to survey tax changes with an eye toward what they would do to the U.S. manufacturing sector.

Where are we going from here? There are conflicting pressures. President Bush wants to undo another major piece of damage in the 1986 tax act which was the elimination of separate treatment for capital gains. I have explained how the income tax doubled taxes saving. There is a third layer of taxation, a sort of triple tax in the corporate sector. You have all heard of the double tax on dividends which is in fact a triple tax on top of the ordinary double tax. It is the same with capital gains. If the firm earns money and pay tax on it and then pays the money out as a dividend, the shareholder must pay tax again. But if the corporation earns money and pays tax on it and retains the earnings either to buy back debt, buying a new piece of equipment, or in some way expand its earnings power, the price of the stock will reflect the retained cash so the share price goes up. If the shareholder sells it and has to pay tax on that at ordinary rates, he is paying just the same double tax as if there is a double tax on dividends. Both the double tax on dividends and the capital gains should be simply eliminated and the Treasury is studying ways of ending the double taxation of dividends and the President has proposed capital gains relief.

Some of the Democrats and Republicans on the Hill have proposed rolling back the payroll tax increase that we recently had. The system is running a surplus but, of course, government is using that to offset general expenses. The payroll tax is a tax on labor; it does reduce employment. And if we can bring spending under control it should be a candidate for rollback sometime in the future. To pay for it, however, some of the Democrats are urging that we either extend the payroll tax to cover all income which raises the tax sharply on upper income workers. Others propose taking the 33% surtax bubble and extending it into a permanent bracket, forgetting that it was there, in fact, to penalize the upper income for having gotten 15% bracket in the first place, thereby undoing the trade-off of lower rates in exchange for closing of loopholes. It is a wholly specious argument and a rotten suggestion. Senator Moynihan would not lower the payroll tax rates now but he would raise them as needed to pay for the retirement of the baby boom in the

future. That would, in fact, lead to pressure to raise income taxes today, payroll taxes tomorrow, ending up with a net increase in the tax burden. I would not recommend that.

Where should we be going? Except for interest outlays, the government is actually already in surplus. We are in programmatic terms running a surplus and it means that the debt is no longer growing faster than the GNP. Contrary, the economy is outstripping the debt, interest is falling as the share of the budget - we are over the hump. All we need is to avoid a recession through whatever might cause that - either a tax increase or an excessive credit crunch by the Federal Reserve. I would urge you to focus squarely on depreciation write-offs as the thrust in the department. I would urge you to do this for all industry. I don't believe that government can pick winners and losers and, as was referred earlier, we need to cooperate with the whole industrial base, buying things off the shelf where we can, going into joint projects, and so on. Just as a warning, there is one industry in which the government has been very heavily involved for many years and that is the financial industry, particularly the S&L's. I would urge you not to try to pick winners and losers out of DoD.

Globalization! I have among the other handouts on the back table left you with two papers on the tax treatment of U.S. multinational firms. I am not as concerned about keeping track of them or worrying about whether they are going to keep their hand in meeting U.S. defense needs as Tom Murrin earlier this morning; but I do think that you ought in thinking of multinational firms realize that they are basically good for us. They get their investment abroad in place and here. They do not trade one off against the other; they do both. They expand their economy as a scale; they become bigger in the world market share; they become better sources of R&D and technological advance. They achieve many savings by going international. We should not be trying to corral them back into the United States with higher taxes on them than on any other group of multinationals in the world. The U.S. tax treatment
of multinational corporations is far more punitive than that of any other major nation.

Now in all of this I hope that you will recall what has just happened in the world. We crazy right wing, free market ideologues who said that prices gave signals and told people what to produce, and where to produce and how to produce it, that taxes were bad, that markets worked - we crazy ideologues happen to enjoy very much the collapse of the planned industry and the planned economic systems in Europe and in Asia. These things were bad, not because we were crazy and simply said so out of thin air, but because they really were bad and we should not be adopting a Russian or Chinese planning model for any sector of our economy, least of all for the defense sector, because that's the one that really has to work right.

I would also urge you not to be seduced by Congressional arguments that "Oh, we need a tax increase to balance the budget." The deficit by itself is bad. There are many ways of financing federal spending and most of them are bad. If you try to increase taxes, generally, what happens is that you gouge depreciation write-offs or corporate retained earnings which are two of the three sources of private saving. Or you gouge personal disposable income which is the main source of personal saving. Generally speaking, at least in the short run, private saving collapses by as much as the tax goes up. The net effect on national saving is virtually zilch and it does not help the national saving rate. If Congress can avoid some of the spending that it does which might be somewhat wasteful, that does reduce government borrowing and does not harm personal saving and national saving is in effect improved.

Don't be misled. A tax increase under the Gramm-Rudman rules means less spending restraint and it does not mean a lower deficit. I would urge you also not to start saying, "Well, don't tax industry but tax individuals." You have to pay their salaries. They will charge you for that. You won't come out ahead. I would urge you not to urge Congress to do more tampering on the personal side because they will attack savings. They will attack IRA's even more strongly. They will attack private pension plans and so forth. I don't think you can win by that route. Congress loves it when the public starts fighting among itself to shift the tax burden rather than turning to Congress in a united way saying "Hey, enough is enough. You guys have more money than you need to spend."

As for the trade picture, I think we should be cooperating with our foreign trading firms. I had suggested at the Interagency Working Group on Semi-Conductors that rather than having DoD try to come up with billions of dollars to invest in the industry, maybe some of the firms could go into joint ventures with the Japanese. I was laughed at. I'm laughing back. There has been a whole flood of that in the last few months. I think there are many positive things we can do that will really light a fire under American business. When they had the opportunities in the early 80's they took it. In the post-1981 recession expansion investment ran at twice the rate of the previous five economic recoveries and consumption barely kept pace with the historical pattern. It was not until 1982, 1984 and 1986 tax acts that the investment boom fizzled. The country is willing to get behind you. All they need is a chance. And that chance needs to come from them up and not from Congress down. Thank you very much.

MANAGING THE INDUSTRIAL MODERNIZATION PROCESS

PRACTICE PANEL

MR. BRIAN FLETCHER will moderate and bring experience from successfully **"DOWN-SIZING"** as a form of modernization. He is Engineering Manager and has served as President and Chairman of the Board of the Project Management Institute.

MR. JACK JOHNSON, Vice President for Manufacturing, Harris Corporation will share experiences on **"IMPLEMENTING TQM"** and how industrial modernization relates.

DR. RICHARD JACKSON, Deputy Director, Center for Manufacturing Engineering, National Institute of Standards and Technology, will emphasize **"TRENDS IN ADVANCED MANUFACTURING TECHNOLOGY"** and the appropriate levels of implementation for both the short term and long term.

PRACTICE PANEL

Presentation by Mr. Brian Fletcher - Moderator

Good Morning! As you already know I am a Canadian, really a displaced Englishman, but I am very happy to be a Canadian ambassador in your nation's capital. May I have Slide #1 please:

SLIDE #1 (NOTE 1)

Then Slide #2:

SLIDE #2

I live in Hamilton and I work in Port Dover. Slide #3:

SLIDE #3

There is a very important part that I think I can play in this conference and, in particular, in this practice panel because probably for the last eight years I have been experiencing the very same thing, the very same difficulties, that many of you, I believe, will be experiencing in the trying times ahead. The steel industry has provided my bread and butter for more than thirty years. There were massive growth times in the 50's and the 60's characterized by bigger is better. There was heavy capital investment in production equipment. This continued in the 70's even spilling over into the 80's. Like many steel corporations, my company had its two best consecutive quarters in 1981 and even before the beginning of 1982, there was a terrific decline in world steel demand. We were not as quick to adjust as we might have been and we suffered then ten straight quarters in the red. Although we fared better than many in the industry we could still be a barometer in that we exemplified the successful action and the not so successful action and the observations that I've got have been unfortunately through some tough experience. So I am going to suggest for your consideration some of the initiatives that we had to take and are still going to have to take. And you can view them in principle. Next slide:

SLIDE #4

I think the four pressures speak for themselves that are going to be forced down and they will act together in the 90's on the defense systems industry. It is doubtful that any decade began with so many negatives. At least four main factors will unfortunately all work together. We've got one major one and some minors ones but unfortunately they all go down. Next slide:

SLIDE #5

We will obviously have to change. There will be some very fundamental changes - moving to new organizational structures and we are going to have to cultivate the markets that we gain. Next slide:

SLIDE #6

NOTE 1: Slides are provided at the end of narrative transcription

While in the case of the steel industry, it was a rapid decline in steel demand and the third world manufacturings of the minor, one could see parallels here - there is a big one and a number of minor ones. All down. I think the key is to be proactive and like the causes that were rapid and severe, the cure medicine will have to be administered swiftly. That is you start the medicines swiftly. An antibiotic isn't going to work for me tomorrow if I take it tomorrow. One has to start on the course, start early and stay with it. Next slide:

SLIDE #7

I think the driving forces will be, a great focus on quality assurance and major advances in manufacturing. My two colleagues will address those issues. My presentation will really be toward restructuring. Next slide:

SLIDE #8

I am going to urge you to prepare and offer some pointers on minimizing the pain of restructuring. That's what I'm about. Next slide please:

SLIDE #9

There isn't any magic formula that will make us immune and we can be assured that it's not going to be business as usual and no less a person than Iacocca says this best. This is a letter to Chrysler suppliers. My company supplies to Chrysler. This is his name at the bottom but I pulled out a number of the things that are in the letter. What he basically is saying is, "Don't confuse 1990 with 1980's." We are going to have to make tough and prudent decisions. Next slide:

SLIDE #10

Now with today's 20/20 hindsight we can see that there were enough signs in the early 80's to forewarn of the calamitous downturn and we were locked in a strike at that time so it was not hard to see why we would tell ourselves that there were more pressing issues. The signs were there. And I'm showing this graph only to show that the outlook was always optimistic. We did not forecast on the down slope. We always forecast at the high point of the up slope. I don't think that our industry is any different than many other industries. We want to be optimistic. We don't like to look at the tough times. By this kind of forecasting you can start to see how by 1985 we'd not really grasped what was happening. We still pointed up and yet we'd been in decline for three years at that time. Next slide:

SLIDE #11

Now the world went down but North America fared worse than many other places for it was in 1981 that 390,000 people were working in the steel industry in the United States and in five years we were down to 163,000 and it has leveled out. It's probably in around 160,000 to 165,000. Next slide:

SLIDE #12

It obviously hurt people and I'm sure that many of the people felt just like those four blast furnaces all going down all at one time. Obviously, equipment went down and people went down. I just wanted to pick that one slide, just to try to express the point of the drama and the hopelessness to some people at that time. Next slide:

SLIDE #13

The problem today is that we still have an industry that is capable of producing more than is necessary. The demand line is still down yet. It is beginning to look up this year, in fact, if I'd have spoken to you four months ago I would have said that it is fairly flat as most of the writers were saying. But things are beginning to look up for us at the moment. Next slide:

SLIDE #14

These were the other things that we really didn't grasp. We did not realize that our other major competitors were reducing costs and were providing a higher quality product. It wasn't so much that they were making more; they were investing their capital in the kind of thing that produced quality. And that is what is necessary today. So we are running a little behind the time in that regard. And we failed to recognize what we were not doing. We were helping third world countries, not appreciating that there would be a double barrel effect. From the time that they put their steel mills into operation, they would be competing in the same market. They were previously on the demand side. Next slide:

SLIDE #15

I think that it is a recognition of where one is and, therefore, to be prepared. And I think that is tough. I have not seen that happen so easily in the past. Next slide:

SLIDE #16

I just picked up a couple of examples: U.S.X., for instance, in the beginning of the 80's - an 80% cut; Bethlehem, not quite as generous a cut but look at the money they were losing - $2 billion in about four years. Next slide:

SLIDE #17

I will talk about downsizing. It is a tough word. It has now become an accepted on-going corporate activity and therein lies the problem. And I think the extra complication for the defense systems industry is that where this used to be a thermometer triggered by economic depression, right now the social barriers of downsizing have weakened and it has almost become fashionable. And that's what you are going to have to deal with that I didn't. Next slide:

SLIDE #18

The first phase is avoidance and, really, it is the alternate to all of the other three and if done properly and, given the right time, I think the other three can possibly be avoided. If you are the lean and mean company today, it is probably because you are doing all of the things that I have listed there. Next slide:

SLIDE #19

The next one is the perception phase and it is often described by many others as being the first phase. All of the experts will stress starting with Number 1, before it is absolutely necessary you have to recognize the signs early, get time on your side because being forced to take quick staff cuts opens all of the negative consequences of downsizing. Streamlining over the longer stand opens up many possibilities for reducing, so the key word is planning. Next slide:

SLIDE #20

I will just share some of the alternates that my company had. One is inclined to think first of all that downsizing just means staff cutting. It doesn't. Good downsizes, let's say, are those whose stated goal is to build the most efficient and effective organization they can, to first remain and then improve their position. And, of course, the important factor there is lowered cost, not necessarily staff cutting as an element but measured in employment dollars saved and not necessarily people terminated. So as an alternate to the word termination, we've tried almost all of these on Slide #21, at one time or another, or all of the time: work sharing; 5 days to 4 days; reducing salary level. We were extremely successful in transferring people - very little retraining as a matter of fact; but we found it an advanced idea that rather than hiring a new person into a particular position, we were able to transfer from one department to another. For about two years part of my pay came in shares. The word layoff is rather abrupt but there are many kinds of layoffs. There is the indefinite or definitive or, really if you're going to severe ties, there are many other ways of doing that: severance pay, we bridged it in many cases, forward assisting and, I purposely didn't write these out, but we had VERP's, SERP's and CERP's - volunteer early retirement, selective and finally compulsory. And we took quite a long time to go all the way from there down to there. Next slide:

SLIDE #21

Really the last stage is staying on the diet and the pruning doesn't stop after you have pruned. Any company that has carefully planning its downsizing should be able to avoid, "What can we do now that they are all gone?" And whichever way you arrive at that condition, being lean, the methods are simple to handle the forth phase and staying on the diet. And there are many, many ways. I picked three that I am somewhat familiar with in zero based evaluation. Next slide please:

SLIDE #22

This is a case of where you assume that the position, for example, doesn't exist. And one has to be vigilant. Particularly bureaucrats have a good habit of creating budget alternates that lump together critical functions with the more marginal ones, leaving their superiors little choice but to approve the package. And I think viewing an issue from the ground up, starting with the assumption that it doesn't exist, has much merit and can often lead to a flatter organization and the sharing of functions. Next slide:

SLIDE #23

The second one that we have had some success with is that there is a tendency to do all things in-house and, in our case, with 950 engineers it would make good sense in the heyday of the 70's. But now with the mature economy it serves mainly as the formula for generating overhead. And

I think the good downsizer lowers the wall between himself and the outside world. One should resist doing the whole job internally and purchase wisely those services that can be bought outside. I think we should make use of the very specialized talent as well as the concentrated resources where the need is compressed into a sharp time frame. Next slide:

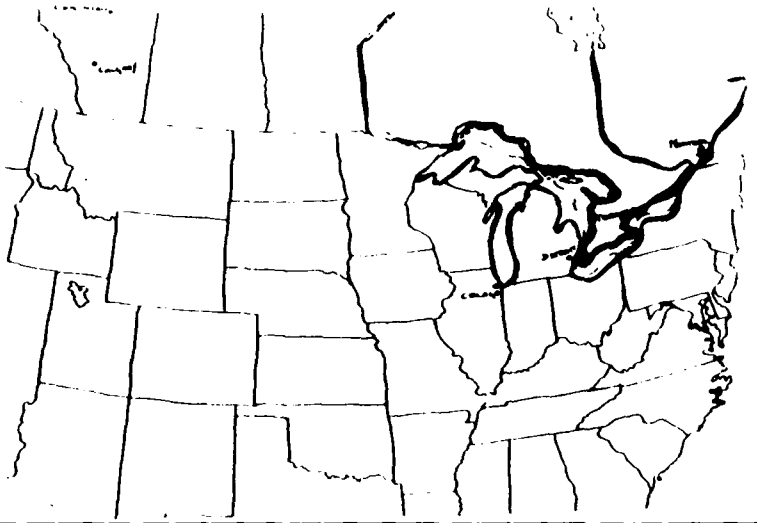
SLIDE #24

This brings me almost to the last one where a third approach which is much, much closer to home, certainly for us, is the chance for project management to come into its own. It is the increased use of the project team taking as much advantage of the matrix management as possible. And when you are down to only one pastry chef and one wine steward, then special task force assignments is one practical way of looking for advantage where one might originally view the situation as a penalty. In some businesses it may be a whole new culture. I am going to leave you with just one last slide:

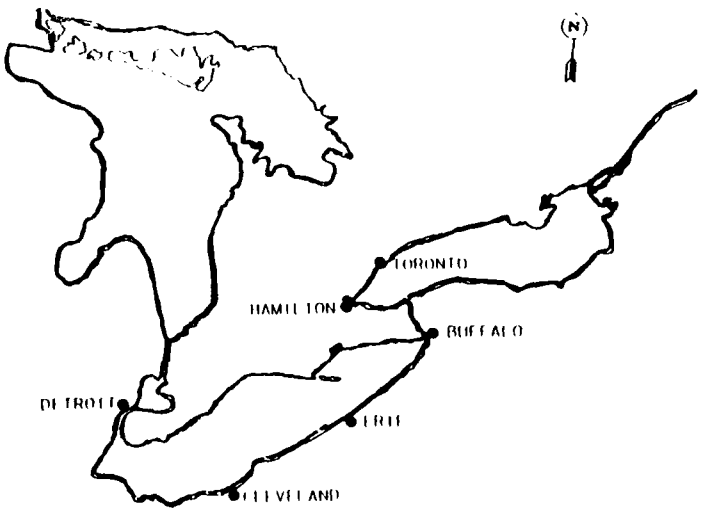
SLIDE #25

I think these are the pressures that the defense systems industry is facing. One thing I would ask is that if I am saying things that people don't want to hear, don't shoot the messenger. Thank you.

Slide #1



Slide #2



Slide #3

PARALLELS

BETWEEN:

: EXPERIENCES IN THE

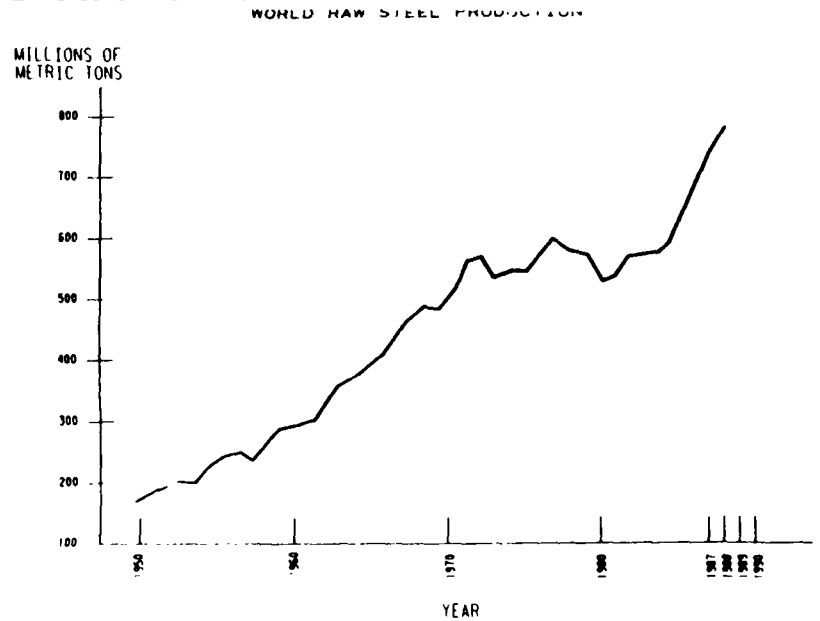
: STEEL MANUFACTURING IN THE 80'S;

AND,

: DEFENCE SYSTEMS INDUSTRY IN THE

90'S

Slide #4



Slide #5

CHANGES IN EASTERN BLOC COUNTRIES.

SLOW ECONOMIC GROWTH.

FIERCE COMPETITION OUTSIDE NORTH AMERICA.

DOWNSIZING - A REALITY.

Slide #6

ADOPT SOME VERY FUNDAMENTAL CHANGES IN OUR MANUFACTURING PRACTICES.

MOVE INTO NEW ORGANIZATIONAL STRUCTURES.

DEVELOP NEWER MARKETS TO REMAIN IN BUSINESS

THEN

CULTIVATE THOSE MARKETS TO CONTINUE TO BE PROFITABLE.

Slide #7

RAPID DECLINE IN STEEL DEMAND.

THIRD WORLD MANUFACTURING REVERSALS.

FIERCER OFFSHORE COMPETITION.

LACK OF COMPARABLE CAPITAL INVESTMENT.

Slide #8

A GREATER FOCUS ON QUALITY ASSURANCE.

MAJOR ADVANCES IN MANUFACTURING.

RESTRUCTURING TO PROPERLY MEET THE CHALLENGES OF COMPETITION AND THE OPENING UP OF NEW MARKETING FRONTIERS.

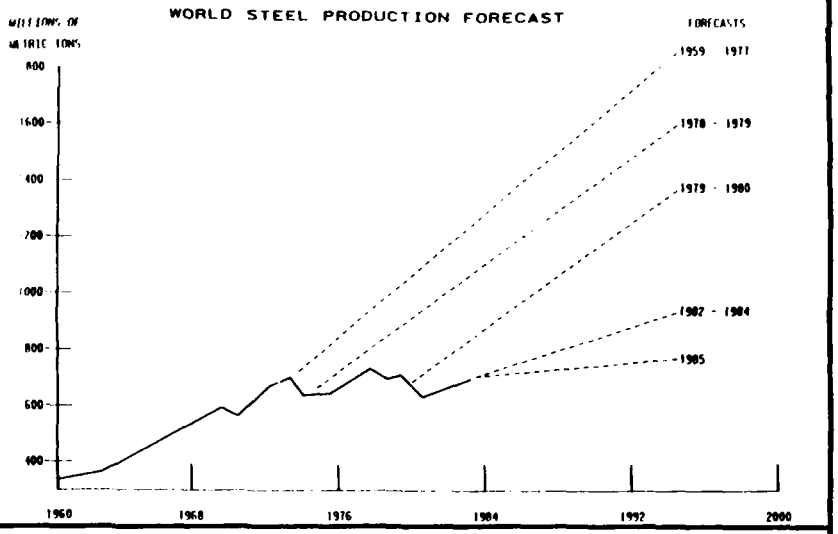
Slide #9

URGE YOU TO PREPARE.

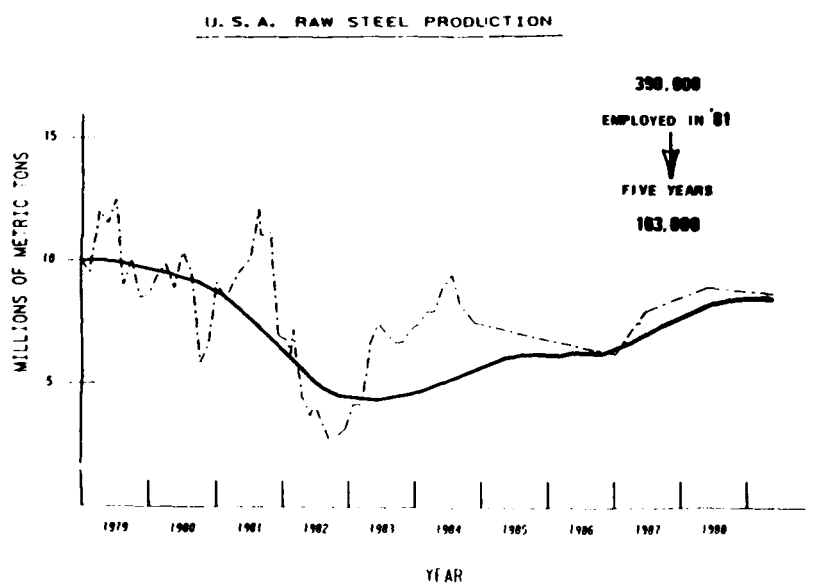
OFFER SOME POINTERS.

SUGGESTIONS.

Slide #10



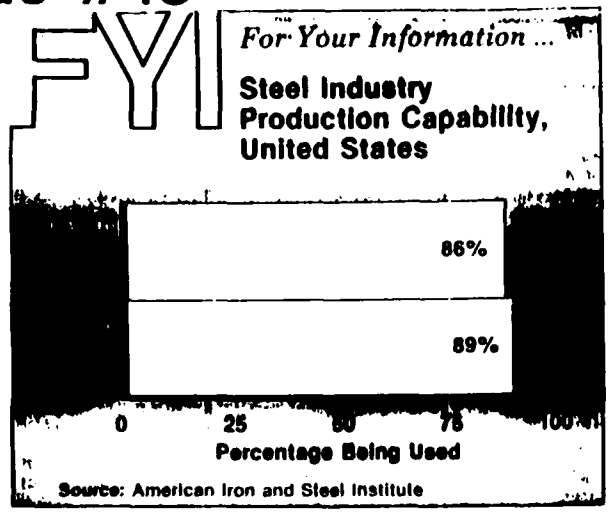
Slide #11



Slide #12

Fig. 2 - Four blast furnaces being demolished at U.S. Steel's Ohio Works.

Slide #13



JANUARY 1990, I&SM-7

Slide #14

* LACK OF CAPITAL SPENDING IN NORTH AMERICA COMPARED WITH THAT OF OUR OTHER MAJOR COMPETITORS ON EQUIPMENT THAT NOT ONLY REDUCED COSTS BUT WHICH PROVIDED HIGHER QUALITY PRODUCTS,

* AND FAILURE TO RECOGNIZE THE SUBSTANTIAL HIGH RATE OF INVESTMENT BY THIRD WORLD COUNTRIES THAT WOULD HAVE THE DOUBLE-BARRELLED EFFECT OF CANCELLING A MARKET PREVIOUSLY ENJOYED IN ADDITION TO THERE BEING AN ADDED NEW SUPPLIER TO THEN SHARE THE MARKET.

Slide #15

RECOGNITION

BEING PREPARED

Slide #16

DOWNSIZING HAS NOW BECOME AN ACCEPTED ON-GOING CORPORATE ACTIVITY, INDEPENDENT OF ECONOMIC EXPANSION OR CONTRACTION.

USX, BEGINNING OF THE 80'S

100,000..... IN 5 YEARS..... 19,000

MANAGEMENT 9,600..... 2,900

BETHLEHEM 83,000 GOING TO 35,000

2 BILLION $..... 1982..... 1986

Slide #17

4 PHASES

: Avoidance

: Perception

: Reducing (Restructuring)

: Staying on the Diet

Slide #18

1. Is the staff doing what it is supposed to?
2. Is it keeping to its budget?
3. Is it improving its productivity?
4. How much would be spent if its function had to be restarted from scratch?
5. How do its size and cost compare with the equivalent staff in other companies?
6. How do the details of its performance compare with other staff groups?
7. How do its customers think it is doing?
8. How much do its activities really cost?

Slide #19

PERCEPTION -- BROADER OBJECTIVES

Lowered Costs

Faster Decision Making

Quicker Response to Competitors Actions

Less Distorted Communications

Greater Action-Orientation, Less Analysis Paralysis

Quicker Diffusion of New Ideas

Facilitating Synergies with the Company

Higher General Manager Morale

Focusing on Customer Needs (Not Internal Procedures)

Giving Authority to Managers Closest to Customers

Easier Ways to Pinpoint Individual Responsibilities

Increase Management Productivity

Slide #20

PERCEPTION

: Get Time on Your Side

: Planning

Slide #21

ALTERNATES TO TERMINATION

- Work Sharing, i.e. 5 --- 4
- Reduce Salary Levels
- Transfers (Poss. Retraining)
- Shares
- Layoffs - Indefinite
  - Definitive
  - Sever Ties
    - Severance Pay
    - Bridged
    - Assisted
      - VERPS
      - SERPS
      - CERPS

Slide #22

Staying on the diet.

Zero based evaluation.

Keeping the habits from returning.

Further implementation of project management.

Slide #23

KEEPING HABITS FROM RETURNING

- Root Cause
- Maintain Low Overhead
- Purchase Wisely

Slide #24

ZERO BASE EVALUATION

- Assume it does not exist.
- Sharing of functions.

Slide #25

SOME PERSISTENT PRESSURES

- Changes in Eastern BLOC Countries
- Slow Economic Growth
- Strong Overseas Competition
- Globalization of American Companies
- Declining Commodity and Energy Prices
- The Second Phase of Deregulation
- Merger and Acquisition Trends
- Privatization

Slide #26

PROJECT MANAGEMENT

- Team Approach
- Advantage of Matrix
- Positive - Advantage not Penalty
- New Culture?

PRACTICE PANEL

Presentation by Mr. Jack Johnson

We at Harris Corporation have taken a somewhat different approach to what is precisely the same threat that challenged the steel industry. That is, diminishing markets and global competition. Ours has been tc eliminate waste by radical change to our management systems and our work culture. Popularly known as "total quality management" we prefer to think of it as getting back to the basics. We call it at our plant, "The People Program -Performance Excellence - Our People Lead the Effort". We have been at it for ten years and we've given ourselves credit for about six of those ten years of real meaningful progress. During that time we've seen defense products go abroad. Some key plants going off shore. Companies like ours exiting the defense market; others putting their defense divisions up for sale and, at least, one saying that it will no longer accept fixed price development contracts. Throughout this shakeout we have at least held our own and are looking forward with some confidence to the future. The jury is still out on that. I think that time will tell whether we are right or whether we are going to prove once again that ignorance is bliss.

Let me tell you just a little bit about who we are before I get into any details. At our company our electronics systems sector consists of six divisions doing about 800 million dollars a year in sales, all in government contracts, historically, mostly to the DoD. We are an electronics system prime about half the time and the other half major subcontractors to the big seven airframe primes and to other electronics primes. Within the field of electronics our technologies are very, very broad; they go from DC to daylight as they say. We are highly R&D oriented, in fact, we have more people in engineering than we have in manufacturing. And finally, those 800 million dollars a year of sales are comprised of, on the average, 1400 open contracts running at a time during a given fiscal year. So if you divide those numbers out you can see that the average contract size that we have is very, very small indeed. We are singles hitters and we are a great big job shop. Now in order to support 1400 different undertakings at a time, we are and have been for a long time, a highly matrixed organization. I believe we are aces at project management; we are absolutely lousy at process management.

In the early 80's we began our TQM journey like a lot of other people with quality circles and, like a lot of other people, we found that quality circles did not work very well for three reasons: firstly, they were focused on productivity rather than quality; secondly, they were not highly structured so that the quality circles didn't know what to work on. They weren't doing things they were familiar with like the food in the cafeteria and the parking situation and the benefit program and so forth; things that only marginally contributed to our competitive success. But mostly quality circles didn't work for us because we felt they didn't have anything to do with management. And as it turned out, it has everything to do with management. Our first real breakthrough occurred in late 1983 when we introduced a set of principles that we called, "Total Quality Control." Those include statistical process controls, designed experiments, Taguchi methods and so forth. These tools have primarily to do with the nature of inspections and the ownership of quality - who is it that is actually responsible for the quality integrity of the goods and services produced internally to our company. In other words total quality control is about doing things right the first time.

In late 1984 our next breakthrough occurred in our employee involvement phase. This involved the empowerment of multifunctional work groups to take some control of the processes that they were responsible for and given the means to affect some change. This phase also introduced

internal supplier/customer relationships and changed forever the relations between suppliers and customers, between workers and managers, and enabled us to introduce, at least internally, some of the principles of quality function deployment - probably our most important breakthrough.

In late 1987 we extended our program from what had previous been an internal one into our supplier base. We do about 70% of our work inhouse and 30% of our dollars flow right through us to our supplier base. Traditionally, we had bought from over 5,000 different companies, not any of which knew enough about Harris in order to join us in a strategic alliance. And we could not know enough about any of those 5,000 companies to reciprocate. So part of our supplier improvement phase has entailed the reduction of our supplier base to a manageable size. Of 2500 of those suppliers, we have reduced by almost 90% to a selected alliance with 276 companies that are our only authorized sources for those commodities going forward.

Our latest breakthrough occurred in 1988. We called it our "just in time" phase. Those of you that are involved with manufacturing know that particularly in the defense industry we have traditionally shoved work through an imaginary pipeline beginning with the first person to work on a contract, handing off to the second person, ready or not, building up inventories in the hopes that someday something would dribble out of the end of the pipe that we could deliver to our customer. Well, JIT turns that all around. It begins with the last internal customer who is the group that runs our shipping dock and creates demand on the next to last supplier to that customer for the next work to be done, creating a natural system of prioritization. Whereas TQC is about doing things right the first time, "just in time" is about doing the right things right the first time. We are currently working on trying to define what external quality function deployment means in a monopsony and as soon as we do that I believe that will bring about the next breakthrough for us. The one following that is going to eliminate two management levels and flatten our organization. Those breakthroughs are already in sight for us.

To give you some evidence that that really works, at least for the benefit of the ultimate customer, let me make a few comments about the B-1 program. We built the electrical multiplexing system for B-1. That is a system that time division multiplex is all the power control functions on that aircraft and sends them down a single twisted shielded pair rather than the 80 miles of wire that otherwise would have been required. That is basically what EMOX does. It consists of 13 LRU's on each aircraft of three different design types. In the area of quality using the principles I just described, we were able to deliver EMOX to the Air Force at 6 and 1/2 times the reliability that it was specified to have and we attribute virtually all of that to doing it right the first time and doing the right things. In the area of costs we gave our customer, Rockwell, back 90 million dollars against our certified DD633 estimates. We thought the program would cost 300 million dollars. We did it on a firm fixed price basis for 208 (million dollars). Again we attribute virtually all of those reductions in cost to what you know as total quality management. And in the area of delivery we never missed a delivery of anything, paperwork, reports, hardware or otherwise in the three years of the production run. In fact we delivered everything we could as far in advance of the contract date as the logistics system at Rockwell would permit, typically up to 60 days. So that is the program that ran concurrently with some of our beginnings in total quality management and we believed served to make us much more competitive.

Now a lot of industrial people said "Why would anybody in their right mind do that?" You know you have reduced your orders secured by 90 million dollars, your sales by 90 million dollars and your profits by whatever the weighted guidelines says that you could have out of that 90 million dollars. Why would you do something like that? Well, TQM is a marketing strategy for us. We

have to become more competitive because the only way we can grow in a flat or declining market is through growth in market share and the only way that we can do that is by winning jobs that we would have otherwise lost to our competition. So to us, at least, TQM is a part of our survival.

Now having said all of that I also need to confess two things here. Number one that ten years is not long enough. We are just beginning on the journey to total quality management and I can tell you that the list of problems that we have to solve is not only longer now than it was when we started it but the problems on that list are much more difficult to solve. We are just beginning. The second confession is that TQM by itself is not the guarantor of our survival by itself as a defense contract. For one thing, as Dr. LaBerge said, our market is too unstable and unpredictable. It is changing faster than our own bureaucracy can keep up with it. Knowing which programs to get on is currently at least as important as having a quality product and service to offer. And number two, and this is probably intellectually obvious, it took me a while to really figure it out, but TQM's improved productivity increases capacity at least at the rate you would with automation or building new plants or whatever. So it creates unneeded capacity in the kind of marketplace we have. So because of that some downsizing has been occurring at our company. Our sales are flat but our work force is quite a bit smaller now than it was six years ago. I also have to tell you that our general managers are beginning to ask the question where we need any manufacturing capacity at all. That's a very sobering question, I think, and one which I as the Executive Vice President of Manufacturing don't have the answer to right now.

In addition to all of this there are two other things that need to be done that I'd like to leave with you this morning. Dr. LaBerge set this one up for me very nicely too. 1) Defense companies must also seek non-DoD markets in order to a) fill and maintain capacity in skilled work force and b) to product those key technologies that we are always going to need for defense. And I think it is in the interest of the DoD that we do this and the government should encourage it. Fortunately, right now at least, there are other government markets outside of DoD that are not suffering with declines that the DoD is and are offering opportunities for defense contractors. These include NASA, FAA, Federal Emergency Management Agency and so forth. I believe that those of us that maintain their industrial capacity are going to have to go even beyond that into commercial market places. That has traditionally been thought to be impossible and in the current paradigm it very well may be impossible to share production contracting or government and commercial sources at the same time. Therefore, we need to change the paradigm; so the second area that we need to work in, and I say we I'm not just talking about the DoD here. The government should eliminate regulations and how to do it specifications that force companies to incorporate expensive systems and practices that add no value to delivered goods and services. I'm talking about regulations and how to do specifications that, I believe, are apt to escape the defense management review system as we are currently doing.

And I will leave you with three examples; there's a whole lot more. #1) progress payments. I believe that if we eliminated progress payments entirely we would all be amazed at the auditing oversight and industry bureaucracy that will prove to serve no purpose at all. Now don't go telling my boss that I made that recommendation without the caveat that it needs to be replaced with something else. There are other ways to finance government contracts than progress payments. I think we ought to revisit milestone payments and completion of that payment schedule to put some teeth into them and/or take another look at the weighted guidelines of the profitability of government contracts will make it possible to finance the negative cashflows that go with that. But we do a lot of things in the name of auditing in behalf of progress payments and the partial entitlement that goes with that. I think we'd find that we didn't need to do any 10 key element

auditing. We could implement just in time, a cost contracts, comable materials and so forth.

Now my second example is Mil-Std-2000. Most of what is said in Mil-Std-2000 does reflect best commercial practice but I think that we will find that that spec is based on three, this is the solder spec for those of you not in the business, was founded on three very shaky assumptions. Number one is that the solder problem is significant. In our company we have averaged well over a million solder joints a year for the last nearly forty years and in searching through all of our product assurance records we have only been able to find two solder joints out of all of those millions that was ever found to be defective after we delivered the product. One of those solder joints was one that we had not soldered at all and the other was a cold solder joint but both of them were discovered accidently in visual inspections and had not caused an operational failure. Assumption number two is that visual inspection is related somehow to later failures and there is very little empirical evidence to suggest that is the case. And number three is that activated flux is bad. Removal of activated flux triples the defect rate on solder joints no matter where you are. And all of the rest of the disciplines imposed in Mil-Std-2000 are designed to get you back to where you would have been if you had used activated flux to begin with.

The last example I want to use is Mil-Std-1567 which I refer to as the industrial engineers' full employment act without any apologies to anyone. This specification defines a reporting system which is masquerading as a measurement system. It address somewhere between 6% and 10% of our cost of goods sold with an army of industrial engineering standards and measurements and so forth. It adds no value whatever to goods and services delivered to anyone and I said imposes a reporting system. Somehow or other we need to convince Congressman Boxer and Ernie Fitzgerald that they are completely wrong. Now I know that this is a tall order and the DoD can't do it by itself. You know we are going to have to change some thinking in our Congress and in order to do that we are going to have to change some thinking in the press and that is all of our responsibilities as citizens in this country. I don't have the foggiest idea of how to do that. We need to get our head together though and work on it and whoever thinks of a way to do that, I think, is guaranteed a Nobel Prize in something. I'll certainly vote for them. Thank you very much.

PRACTICE PANEL

Presentation by Dr. Richard H.F. Jackson:

Good morning. First, I want to say that I am delighted to be here and to participate in this conference. I also want to express my appreciation to the organizers for putting on such an outstanding program and for inviting me to be a speaker. Next, I need to clear up a few issues. As a scientist, it's true I view my whole life as a learning experience, but it has in fact been quite a few years since I have been a student. If, by referring to me in your introduction as a student, Elvin, you meant to compliment me on my youthful appearance and boyish charm, I am grateful.

I am also pleased to be put in the same category as the practitioners on the panel. However, I must point out that they are the real practitioners, whereas I am in a middle ground between industry and academia. The National Institute of Standards and Technology is the only federal agency that has a specific mission to support industry. It is the central reference laboratory for information about data, standards, and measurement techniques required by U.S. industry. The Center for Manufacturing Engineering has the specific mission of bringing to bear the resources of NIST to support the discrete parts manufacturing industry. This puts our staff close to both industry and academe, and therefore in the middle.

Now, I know that I am the last speaker before lunch, and have the unenviable task of keeping your interest while your stomachs indicate interest elsewhere. So I will proceed into my talk without further delay.

SLIDE #1 (NOTE 1)

Ben Rush asked me to talk to you today about trends in manufacturing. That's a difficult task, but I will begin by discussing the trend that we at NIST refer to as the recognition of a new manufacturing reality.

SLIDE #2

This new manufacturing reality has arisen as a result of four concurrent phenomena: the rise of global markets; the demand for world class products; the subsequent move toward small batch manufacturing, allowing manufacturers to produce parts just in time, not out of inventory; and the emergence of flexible automation as a method of achieving small batch production. You've heard other speakers talk today about world class products.

SLIDE #3

We define them to be products that have the most modern features, the lowest cost, the highest quality, and are produced on time. I want to give you an example of what it means to produce world class products. There is a Japanese manufacturer that is a 6 billion dollar per year producer of auto components. They supply every automotive manufacturer in the world. In November of 1986, they opened a completely integrated, fully flexible manufacturing line, producing 300,000 units per year of a hundred different models of air conditioners. They produce them in batches of thirty-six with a defect rate of 1 part in 10,000. They do this at a unit cost of $50. Those air

NOTE 1: Slides are provided at the end of narrative transcription

conditioners subsequently cost you about $750 when you buy a car. And they do this with a local order to delivery time of four hours. Now, we maintain that if you can do this, you can remain competitive in the world market.

SLIDE #4

Let's return to the main subject of my presentation. There are many trends in manufacturing these days, including trends in measurement methods, production techniques, government policies, university programs, and boardroom behavior. However, I chose to talk today about trends in two areas that are somewhat more subtle, and perhaps therefore, at the cutting edge. I have grouped these trends into two areas: developing and transferring technology, and making more efficient use of advanced manufacturing technology.

SLIDE #5

In the area of technology development and transfer, I have already seen examples of the same thing Mr. Donnelly discussed this morning: the move toward small systems. I have visited plants that have already begun to shift from implementing completely integrated manufacturing systems for the whole factory floor, to identifying and installing smaller units, or subsystems, of computer integrated manufacturing. There is even have an example from our own research at NIST, which I will discuss in more detail later.

The next trend that I want to discuss is the move from computer integrated manufacturing to what is called "human integrated manufacturing." This trend is an acknowledgement that the approach of completely replacing people on the factory floor is not necessarily the most effective way to achieve productivity improvements. More and more firms are discovering there are still many tasks that are best performed by humans. Moreover, if these workers are educated and well-trained, they can provide valuable insights into improving the manufacturing process. This is just one more way to improve productivity, and is just one more aspect of the gestalt of total quality management.

The third trend in this area of technology development and transfer is increased attention to the small and medium sized manufacturing firms in this country. There are, after all, about 130,000 of them producing 75% of all of our discrete parts. There have been some efforts to develop automated manufacturing techniques aimed specifically at these firms. There have also been increased efforts to transfer this technology to these smaller firms.

SLIDE #6

I will illustrate these trends with some examples drawn from the work in the Automated Manufacturing Research Facility at NIST.

SLIDE #7

The AMRF is a fully integrated, completely flexible automated manufacturing research facility established at NIST. It was established, in cooperation with the U.S. Navy, to serve as a test bed for flexible manufacturing systems research performed by researchers from NIST, academia, industry, and other government agencies. The research is basically in the areas of interface standards and advanced metrology to support improvements in manufacturing methods for U.S. industry. Our mission also includes a responsibility to transfer these results to industry.

SLIDE #8 (AMRF Floor Plan - not included)

This is the floor plan of the AMRF. It consists of six workstations, including a materials handling system. I am not going to discuss each of the workstations in the AMRF today, because I want to concentrate more on one of them: the Turning Workstation.

SLIDE #9 (Turning Workstation - not included)

This is an example of the recent increased attention to automation at the subsystem level rather than at the entire facility level, that I mentioned earlier. We built this workstation in cooperation with industrial partners for the U.S. Navy. It is to be installed, in fact even as we speak is being installed, in the Navy's Mare Island Shipyard in California, to operate untended, all day, every day. It produces parts that like those shown in this next slide.

SLIDE #10 (RISIC Parts - not included)

These are resonance inhibiting, sound isolating couplers (RISIC) that reduce sound in fluid flow in nuclear submarines. While the Navy's shipyard facility produces these in their existing manual shop, it takes about 17 hours to produce just one of these parts. The workstation that we built with our industrial partners can produce one of these in under an hour. This 17-1 reduction is an impressive display of the benefits of automation. The Navy will recoup their investment in NIST in approximately two weeks of operation. The Mare Island Project is also an excellent example of technology transfer.

However, the main reason for discussing this project is that it is part of an example of the increased interest in smaller systems. Moreover, the turning station that is to replace the Mare Island Workstation in the AMRF, also being developed for the Navy, is less automated. For example, it won't have a robot tending it. There will be humans performing the material handling, demonstrating the shift toward "humanizing automation," or as I called it earlier, human integrated manufacturing.

SLIDE #11

The Shop of the Nineties program is an effort to increase support to small manufacturers in this country. It is centered in the NIST machine shop which provides a variety of fabrication services to the scientists and engineers at NIST, and is not too different from the average small machine shop in this country. The staff numbers about 60, and it must provide high quality services at competitive prices, since there is no requirement that NIST scientists and engineers use its services.

Several years ago, it became apparent that to continue to do this, we would have to introduce more computer automation to upgrade the equipment in the machine shop. We believed that this experience, if carefully controlled and documented, could be helpful to the small and medium sized discrete part manufacturers in this country. Thus began the Shop of the Nineties project. It is a test bed for automation of small machine/job shops using commercially available, "off-the-shelf" hardware and software technology.

SLIDE #12

The goal of this project is to develop and transfer recommendations, information, and procedures for increasing the productivity and competitiveness of small and medium manufacturing facilities in the U.S. We have worked with nine nationally known vendors of hardware and software to create the Shop of the Nineties project, and, with their help, by the end of 1989, had installed major portions of a CIM system geared to the small job shop. It includes computerized cost estimating, process planning, tool room management, design, and manufacturing. We have held several very well attended seminars and workshops to help transfer this technology to small job shops, and have arranged for a beta test facility with a local firm to continue this technology transfer effort. This entire program is an example of increased attention to the small and medium manufacturing community.

SLIDE #13

Another program aimed at providing assistance to the small and medium sized manufacturers in this country is the Manufacturing Technology Centers Program. This program was established as part of the 1988 Omnibus Trade Bill which also changed our name from the National Bureau of Standards to the National Institute of Standards and Technology, or NIST.

SLIDE #14

The goal of the program is to accelerate the transfer of advanced manufacturing technologies to small and medium sized manufacturing firms. It is unique in the federal government in that it is the first one to recognize the need for an intermediary between the scientists and engineers in the federal laboratories who develop advanced manufacturing techniques, and the staff of the small and medium sized manufacturing firms who can benefit most from making that technology more available.

SLIDE #15

This slide depicts that intermediary role more completely. It also points out the dual role these Centers have. First, to serve as a kind of industrial extension service, developing close relationships with the small firms in their region, and acting as a kind of marriage broker between them and the advanced manufacturing technology that exists in federal labs, especially NIST. And second, if necessary, to extract that technology from federal laboratories and commercialize it by packaging it, refining it, documenting it, or just completing it. This second part is very important because NIST does not make commercial products. These centers, therefore, can help speed these technologies to commercial usefulness.

SLIDE #16

The Centers will receive $3 million per year from NIST, which they must match with another $3 million in cash or in kind. NIST funding will ramp down beginning in the fourth year, and terminate after six years. Ultimately, there will be 12 such centers operating around the country. The first three were established last year at Rennsalaer Polytechnic Institute in Troy, New York, Cuyahoga Community College in Cleveland, and University of South Carolina in Columbia, South Carolina.

SLIDE #17

At this point, I want to turn to the second area of trends in manufacturing: making more efficient use of advanced manufacturing technologies. The primary examples in this area that I want to mention are PDES and CALS. Many of you, I am sure, are familiar with CALS, DoD's $200 million program in Computer-aided Acquisition and Logistics Support, aimed at, among other things, paperless procurement and concurrent engineering. PDES, which stands for Product Data Exchange Specification, is the national effort to support the development of international standards

for the exchange of manufactured parts. Admiral Curtis has said that PDES is the heart and soul of CALS. I agree, and further believe that both are important components of concurrent engineering which Deputy Secretary Murrin discussed earlier today.

SLIDE #18

This is a definition of concurrent engineering. I won't spend much time on that since Mr. Murrin discussed it in some detail earlier today.

SLIDE #19

This next slide, however provides a graphical depiction of concurrent engineering. The basic idea is that everyone who has input to the manufacture of a particular product has access to all of the information about that product throughout its entire life cycle, as shown here. The result is lower cost, higher quality, less waste, and timely delivery to market. Deputy Secretary Murrin talked about concurrent engineering and the need for concurrent management. I especially like the term "concurrent management," and agree that greater attention should be paid to that side of the issue.

SLIDE #20

This slide depicts the PDES environment. This standard, when completed, will include a description of all the information associated with a manufactured part throughout its whole life cycle, including concept, design, advanced engineering, marketing sales, support, and salvage, if necessary. With this international standard in place, our industry will be in a much better position to compete internationally.

One of the major problems U.S. industry has in competing with foreign industries is that, especially in Japan, they have already achieved a kind of concurrent engineering through the stable person-to-person interactions that result from their vertical integration. Our challenge is to achieve concurrent engineering in the typical U.S. environment of continually changing relationships among companies and subcontractors. I believe PDES is the key to doing this. And I believe that concurrent engineering and PDES and CALS will be the basis of manufacturing standards in the 21st century.

SLIDE #21

Some U.S. firms have already implemented embryonic forms of concurrent engineering, and report dramatic savings, as shown in this slide.

SLIDE #22

NIST is heavily involved in the development of CALS and PDES. We work closely with the standards organizations in this area, providing technical support, funding, and in some cases even serving as the secretariat. In addition, we are very pleased to say that the Automated Manufacturing Research Facility has been designated the National PDES Testbed to serve as a research facility for testing new implementations and applications of this emerging standard as they appear.

SLIDE #23

When we began this effort in the early 1980s to address the interface standards and advanced measurement needs of U.S. industry in flexible, computer-integrated manufacturing, there were no such research facilities in existence. Since that time, and since having solved some of the problems that stood in the way, other facilities have appeared. During this time, most of the effort and resources were spent on demonstrating feasibility of the idea.
It is now time to capitalize on the availability of this technology, by continuing research in advanced measurement methods and standards, of course, but also to pursue improvements in the areas of software engineering, data handling, data analysis, process modeling, and optimization. That is, having demonstrated that the idea works, we must now make it work smoothly and efficiently. Perhaps most important, however is to continue our efforts to transfer the fruits of this research to industry.

Especially in America, industry faces greater and greater economic challenges, and increasing emphasis will be placed, not just on technological solutions to these problems, but on our *effectiveness in managing these new technologies*, especially the information-based ones. The AMRF has been and will continue to be a valuable tool in the effort to increase manufacturing productivity and improve competitiveness.

Thank you for your attention. I think it is now time for us to go to lunch.

Slide #1

TRENDS IN ADVANCED MANUFACTURING

Dr. Richard H.F. Jackson, Deputy Director

Deputy Director
Center for Manufacturing Engineering
National Institute of Standards and Technology
Gaithersburg, MD 20899

Slide #2

THE NEW MANUFACTURING REALITY

Global Markets

▲

World-Class Products

▲

Small-Batch Production

Flexible Automation

Slide #3

CHARACTERISTICS OF GLOBAL MARKET PRODUCTS

- Most modern features
- Lowest cost
- Highest quality
- On time

Slide #4

TRENDS IN TWO AREAS

Technology development and transfer

Efficient use of advanced manufacturing technology

Slide #5

TECHNOLOGY DEVELOPMENT AND TRANSFER

- **Complete systems ——→ Subsystems**
- **CIM ——→ HIM**
- **Large firms ——→ Small firms**

Slide #6

THE AMRF: A RESEARCH TEST BED FOR THE FACTORY OF THE FUTURE

Slide #7

AUTOMATED MANUFACTURING RESEARCH FACILITY PROJECT

- **Build a test bed flexible manufacturing system**

Support manufacturing systems research by NIST, Academia, Industry, and other agencies

Conduct continuing studies of interface standards

Conduct continuing studies of advanced metrology

Transfer technology to American Industry

Slide #8

AMRF Floor Plan
(not included)

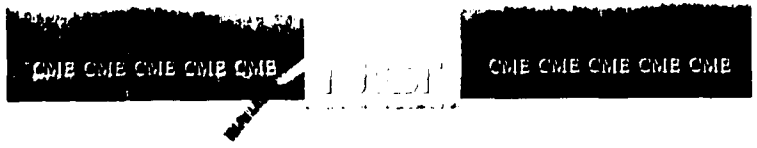
Slide #9

Turning Workstation
(not included)

Slide #10

RISIC Parts
(not included)

Slide #11



SHOP OF THE NINETIES

Test bed for automation of small machine/job shops

"Off-the-shelf" hardware & software technology

Implemented in NIST Machine Shop

Slide #12

GOAL OF SHOP OF THE NINETIES PROJECT

Develop, document and transfer

Techniques and procedures

Improving productivity and competitiveness

Small & medium manufacturing facilities in U.S.

Slide #13

NIST

Regional Centers for the Transfer of Manufacturing Technology

Slide #14

CME CME CME CME CME NIST CME CME CME CME CME

MTC PROGRAM

Accelerate transfer of advanced manufacturing technologies to small and medium-sized business

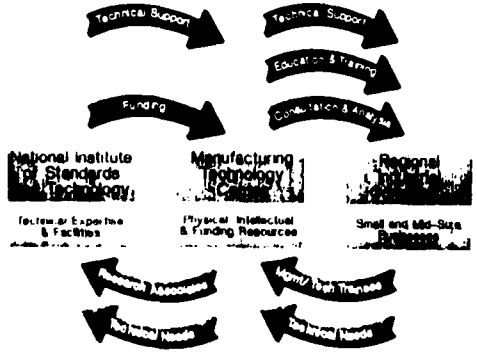
Unique in Federal government

Recognizes need for intermediary

Slide #15

CME CME CME CME CME NIST CME CME CME CME CME

WHAT IS TRANSFERRED



Slide #16

CME CME CME CME CME NIST CME CME CME CME CME

MTC PROGRAM CHARACTERISTICS

Focused on automated manufacturing technologies appropriate for small firms

Cost sharing with state and local governments, industry and academia

Hands-on experience and off-the-shelf technologies

$3M/year, matched at least dollar for dollar

Ramps to $0 at end of sixth year

Merit review of proposals and performance

Two or three new centers each year

Funded through cooperative agreements

Slide #17

EFFICIENT USE OF TECHNOLOGY

PDES/CALS

Concurrent Engineering

Manufacturing standards for the 21st century

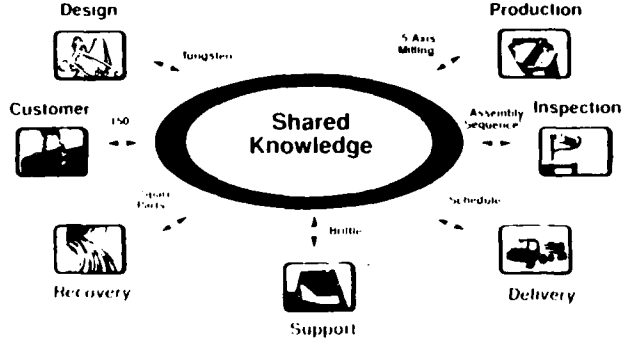
Slide #18

"Concurrent engineering is a systematic approach to the integrated, concurrent design of products and their related processes, including manufacture and support. This approach is intended to cause the developers, from the outset, to consider all elements of the product life cycle from conception through disposal, including quality, cost, schedule, and user requirements."

Winner, et al., "The Role of Concurrent Engineering in Weapons System Acquisition," IDA Report R-338, December, 1988.

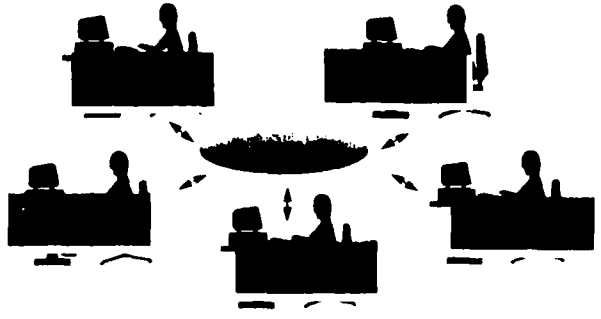
Slide #19

CONCURRENT ENGINEERING



Slide #20

PDES EXCHANGE ENVIRONMENT



Slide #21

SAVINGS FROM CONCURRENT ENGINEERING

Design Changes	50%
Development time	40-60%
Manufacturing costs	30-40%
Scrap/rework	75%

Winner, et al., "The Role of Concurrent Engineering in Weapons System Acquisition," IDA Report R-338, December, 1988.

Slide #22

THE NATIONAL PDES TEST BED

- Test implementations and applications
- Develop software tools to aid testing
- Coordinate with other test beds
- Clearinghouse on standards documents, data and testing activities

Slide #23

SUMMARY

- Feasibility demonstrated
- Continue development
- Improve efficiency
- Transfer technology

Biographies

THOMAS J. MURRIN
Deputy Secretary of Commerce

Thomas J. Murrin was nominated as Deputy Secretary of the U.S. Department of Commerce by President George Bush on May 22, 1989. He was confirmed by the U.S. Senate on June 21, 1989.

Recruited to the Westinghouse Electric Corporation as a graduate student in 1951, Mr. Murrin initially worked as a manufacturing/materials engineer. Over the next 36 years, he served in various positions with Westinghouse, including Corporate European Manufacturing Representative, Corporate Vice President of Manufacturing, Senior Vice President of the Defense and Public Systems Group and President of the Public Systems Company.

Mr. Murrin retired in 1987 as President of the firm's Energy and Advanced Technology Group, an organization with nearly $5 billion in annual sales. In that capacity from 1983 through 1987, Mr. Murrin was responsible for Westinghouse's worldwide operations in defense and aerospace systems; electric energy systems; and people moving systems. He was a member of the Westinghouse Management Committee, the top policy-making body of the corporation, from 1974 until his retirement. Quality and productivity improvement were elevated as key corporate concerns under his guidance.

Building on his extensive foreign travel and study of manufacturing operations overseas, most notably in Japan, Mr. Murrin served as a U.S. delegate to the NATO Industrial Advisory Group headquartered in Brussels, Belgium. He also was a member of the Defense Policy Advisory Committee on Trade (DPACT) with the Department of Defense and served as chairman of DPACT's Subcommittee on Trade Relations with Japan.

He was the first chairman of two private sector advisory committees to the federal government: the Board of Overseers of the Commerce Department's Malcolm Baldrige National Quality Award, and the Defense Department's Defense Manufacturing Board.

Mr. Murrin was a member of the Presidents's Commission on Industrial Competitiveness in 1984 and past chairman of the Board of Governors of the Aerospace Industries Association.

Continuing his longstanding involvement with Pittsburgh-area educational institutions, Mr. Murrin most recently served as Distinguished Service Professor in Technology and Management at Carnegie Mellon University. He also was Chairman of the Board of Trustees of Duquesne University and a member of the Board of Trustees of Fordham University. He served on the national board overseeing "Cities in Schools," an organization working to reduce school dropout rates.

A native of New York City, Mr. Murrin received a bachelor of science degree in physics from Fordham University in 1951, has done graduate work at several universities, and is a Fellow of the National Academy of Engineering. He was born April 30, 1929, and is married to the former Dee Coyne of New York City. The Murrins have eight children.

WALTER B. LABERGE
Holder, Chair for Acquisition Policy
Defense Systems Management College

Dr. Walter B. LaBerge joined the Defense Systems Management College (DSMC) in May 1989 as the Chair for Acquisition Policy.

Before joining DSMC, Dr. LaBerge was Vice President, Corporate Development for Lockheed Corporations. From January 1986, he served as Vice President, Science and Technology. Dr. LaBerge transferred to the corporate staff following two years as Vice President and General Manager of Lockheed Missiles and Space Company's (LMSC) Research and Development Division. He was elected a vice president of the corporation in February 1985.

Dr. LaBerge jointed LMSC in July 1981 as Executive Assistant to the President, was appointed Vice President, Planning and Technology in February 1982. Subsequently he was named to head the Research and Development Division. Before joining Lockheed, Dr. LaBerge was the principal deputy to Dr. William Perry, the former Under Secretary of Defense for Research and Engineering.

Following a 13-year career with Philco-Ford as Vice President of the Defense Division, he became Technical Director, Naval Weapons Center, China Lake, California. In 1973, Dr. LaBerge was appointed Assistant Secretary of the Air Force, Research & Development, and in 1975 became Assistant Secretary General of NATO in Brussels, Belgium. In 1976, he was appointed Under Secretary of the Army, a post he held until 1979.

Dr. LaBerge was one of the principal inventors of the Sidewinder Air-to-Air Missile. He led the team which designed the NASA Houston Mission Control Center for Apollo and led the Philco-Ford Western Development Laboratories during its growth from 12 members to a 2,000 member organization.

Dr. LaBerge was born in Chicago, Illinois. He received a bachelor of naval science degree, a bachelor of science degree and a doctorate in physics from the University of Notre Dame.

He was selected one of Notre Dame's "All Time Men of Science"; has received medals of commendation from the Air Force, Navy, Army and Department of Defense; was commended by the California Legislature for his work on the Sidewinder Missile and was selected as one of California's "Five Young Men of the Year" in 1957. In 1987, he was elected to the National Academy of Engineering. Dr. LaBerge is listed in "Who's Who in America" and "Who's Who in Science."

RICHARD E. DONNELLY
Assistant Deputy Under Secretary of Defense for Manufacturing and Industrial Programs

Richard E. Donnelly was appointed Assistant Deputy Under Secretary of Defense for Manufacturing and Industrial Programs in December 1988. He is responsible for providing policy and planning direction within the Department of Defense to ensure the readiness of a cost-effective industrial production base to meet peacetime and emergency requirements.

Mr. Donnelly was born in Cleveland, Ohio on August 3, 1939. He attended public schools in Ohio and accomplished undergraduate work in Business Administration at Kent State University. He is presently working toward a Masters in Public Administration Washington, D.C. His government training includes the Industrial College of the Armed Forces, Federal Executive Institute and a recent assignment as a Senior Fellow at the Institute for National Strategic Studies of the National Defense University.

Mr. Donnelly has been a professional staff member of the Office of the Secretary of Defense since 1972, serving in a number of key policy positions such as Director for Industrial Resources, Staff Director for Materials Policy and Staff Specialist for Priorities and Allocations Systems. From 1968-1972, Mr. Donnelly served on the Headquarters, USAF staff developing policies for management of Air Force Industrial Resources. From 1965-1968 Mr. Donnelly was an industrial planner of the Defense Contract Administration Services Regional Office in Cleveland.

He is active in several industrial associations and technical societies and is a frequent lecturer at the National Defense University and Defense Systems Management College. Mr. Donnelly is a career member of the Senior Executive Service and has received both the Meritorious and Distinguished Presidential Rank Award from President Reagan.

Mr. Donnelly is married to the former Kathleen Jirovec of Cleveland. They have a son, Scott and a daughter, Erin and currently reside in Oakton, Virginia.

STEPHEN J. ENTIN
Research Scholar
Institute for Research on
the Economics of Taxation

Stephen J. Entin is currently Resident Scholar at the Institute for Research on the Economics of Taxation (IRET), a Washington, D.C., think tank. Mr. Entin is a former Deputy Assistant Secretary for Economic Policy at the Department of the Treasury.

Mr. Entin joined the Treasury Department in 1981 with the incoming Reagan Administration. He participated in preparation of economic forecasts for the President's budgets, and the development of the 1981 tax cuts, including the "tax indexing" provision that keeps tax rates from rising due to inflation.

Mr. Entin represented the Treasury Department in the preparation of the Annual Reports of the Board of Trustees of the Social Security System, and conducted research into the long run outlook for the system.

Prior to joining Treasury, Mr. Entin was staff economist with the Joint Economic Committee of the Congress, where he developed legislation for tax rate reduction and incentives to encourage saving.

Mr. Entin is a graduate of Dartmouth College and received his graduate training in economics at the University of Chicago.

BRIAN FLETCHER
Engineering Manager
STELCO, Incorporated
Lake Erie Works

Brian Fletcher, an active member of PMI since 1972, was educated in England at Newton Technical College and Salford Royal Technical College. He is a chartered engineer in the United Kingdom and a registered Professional Engineer in Ontario. Since 1982, he has been the Engineering Manager of Stelco Steel's Lake Erie Works, a fully integrated steelmaking operation on the north shore of Lake Erie, being previously the Ironmaking Project Manager for that new Lake Erie Works mega-project, which made coke, iron and cast the first steel slab in 1980. Experience also included Project Managing a new Skin Mill operation plus numerous major and minor steel plant expansion programs. He is a member of the Association of Iron and Steel Engineers, given a paper and participated in AISE conferences. Working experience extends back into, a steel works engineering apprenticeship, design work for the Atomic Energy Authority and a major crane builder plus service as a sea-going engineer/officer for Canadian Pacific steamships. Mr. Fletcher is a FELLOW, Past President, Past Chairman of the Board of the Project Management Institute and was Project Manager for PMI 1982 in Toronto.

Community involvement is another aspect of Brian's additional activities, serving four years as a member of the City of Burlington's Committee of Adjustment; being Chairman for two years. He has also served on the Land Division Committee for the Regional Municipality of Halton since 1974, being re-appointed four times and being elected Chairman each of the last eleven years.

JOHN G. JOHNSON
Vice President
Palm Bay Operations Manufacturing
Harris Corporation

John G. (Jack) Johnson is Vice President, Palm Bay Operations Manufacturing, reporting to Phillip W. Farmer, Senior Vice President and Sector Executive of Harris Corporation's Government Systems Sector. Mr. Johnson is responsible for all manufacturing and material functions supporting three Government Systems Sector divisions headquartered in Palm Bay, Florida: Government Aerospace Systems Division, Government Communication Systems Division and Government Electronic Systems Division.

Previously Mr. Johnson served as Vice President, Operations Manufacturing for the Government Aerospace Systems Division. Before that he was Vice President of Programs, managing the Electrical Multiplexing System (EMUX) program for the B-1B aircraft.

Mr. Johnson management experience includes assignments as Vice President, Engineering for the Harris Satellite Communications Division and Director of Operations for the Tracking and Data Relay Satellite System (TDRSS) program. He was also program manager for the development of a Medium Antenna Terminal for the United States Army Satellite Communications Agency and Internal Manager of LA Faire Vite, a complex electronic system located at 14 interconnected sites in West Germany.

Before entering management, Mr. Johnson spent several years serving as an engineer with Harris and Collins Radio Corporation. During this time, he designed and developed an 85-foot antenna in Ethiopia, a 150-foot antenna on Roi Namur, Marshall Islands, a transportable military satellite terminal and miscellaneous installation activities at the NASA Deep Space Instrumentation Facilities at Goldston, CA.

Mr. Johnson graduated form the Georgia Institute of Technology with a bachelor of science degree in mechanical engineering and received his masters's degree in space technology from the Florida Institute of Technology.

DR. RICHARD H.F. JACKSON
Deputy Director
Center for Manufacturing Engineering
National Institute of Standards and Technology

Dr. Jackson is Deputy Director of the Center for Manufacturing Engineering (CME) at the National Institute of Standards and Technology (NIST). NIST is the only federal agency with the specific mission to supporting U.S. industry. It does this by serving as the central reference laboratory, providing measurements, standards, and data to support U.S. commerce. CME's mission is to bring the resources of NIST to bear on the standards and measurements problems associated with America's discrete parts manufacturing industries. Prior to this appointment, Dr. Jackson directed the Manufacturing Technology Centers (MTC) Program at NIST. The MTC program was created by the Omnibus Trade and Competitiveness Act of 1988 to establish a network of regional centers for the transfer of manufacturing technology from NIST to small and medium sized manufacturing firms in the U.S. Dr. Jackson has been with NIST since 1971, spending most of this time as an applied mathematician in the Center for Computing and Applied Mathematics in both Gaithersburg, MD and Boulder, CO.

He is a member of the Operations Research Society of America, the international Mathematical Programming Society, the American Association for the Advancement of Science, Sigma Xi, and Omega Rho. He serves on the Manufacturing Advisory Committee of the Manufacturing Technology Division of the Society of Automotive Engineers, and the Steering Committee of the Initial Graphics Exchange Specification/Product Data Exchange Specification Organization. He has published widely in the fields of flexible manufacturing, technology transfer, mathematical modeling, and nonlinear optimization. Dr. Jackson received his bachelor's degree in 1969 from Johns Hopkins University, his master's degree from Southern Methodist University in 1970, and his doctorate from George Washington University in 1983.

MANAGING THE INDUSTRIAL MODERNIZATION PROCESS

WORKSHOPS

WORKSHOP NUMBER	WORKSHOP NAME

1. **Balancing The Industrial Modernization Agenda**
   Workshop Leader: Mr. Del Babb
   Workshop Coordinator: Mr. Gary Richard

2. **Preventing The Waste of Human Resources**
   Workshop Leader: Mr. William Jones
   Workshop Coordinator: Mr. Dan Robinson

3. **Developing and Validating Capital Needs for Modernization**
   Workshop Leader: Mr. Leroy Jackson
   Workshop Coordinator: LtCol James Daugherty

4. **Integrating Statistical Thinking with Other Improvements**
   Workshop Leader: Dr. Jack B. Revelle.
   Workshop Coordinator: Mr.Bill Motley

5. **Balancing Short-term Financial Goals with Long-term *Investment Requirements***
   Workshop Leader: Ms. Linda Spencer
   Workshop Coordinator: Mr. Tony Perino

6. **The Industrial Modernization Incentives Program (IMIP)**
   Workshop Leader: Mr. Richard L. Engwall
   Workshop Coordinator: LtCol Bill Erie

7. ***Flowing Policy Down To Suppliers***
   Workshop Leader: Mr. Nick Lambiase
   Workshop Coordinator: Dr. Paul Ballou

8. **Are Industrial Networks and Product Data Exchange the Future?**
   Workshop Leader: Mr. Bruce Lepisto
   Workshop Coordinator: LtCol Izzy Caro

9. ***The Use of Multifunctional Development Teams***
   Workshop Leader: Mr. Brian Wright
   Workshop Coordinator: Mr. Henry Alberts

10. **What is Needed in Curricula To Cover Industrial Modernization?**
    Workshop Leader: Dr. David Cleland
    Workshop Coordinator: Dr. Franz Frisch

WORKSHOP SUMMARY PRESENTATION

MR. DEL BABB - Workshop #1 - **Balancing the Industrial Modernization Agenda - Commercial and Government**

We were looking at the balancing of commercial and government business. We have four charts. Obviously, this is a very wide ranging subject and an attempt to boil it down into three or four issues was particularly challenging for the group. We took our best shot.

SLIDE #1

The first thing we identified was the basic feeling that the total acquisition and acquisition execution process was too complex. This is a representation of a whole bunch of sins which are exemplified by our recommendation that we should attempt to simplify the whole process by emulating commercial a lot more. This begins to pick up a whole host of things; starting with the old standby of understanding what your customer really wants and needs, what he is willing to pay for that, and understanding the aspect of value. Then dealing with contracts, the form of contracts, specifications, cost accounting standards, and I might add pricing, data rights, warranties and all the attributes that would go to make up a total acquisition process more commercial in nature. We talked about assuring support to the users needs, and the streamlining idea. The bottom two items-manufacturing process and qualified subcontractors - in effect capture a little bit of the ideas of TQM. In other words we are looking at process control as opposed to the inspection of manufacturing parts and qualified subcontractors as opposed to wide open competition running amuck.

This is a particularly germane subject. Many of you may not know it but Betti just signed out in February what he calls a Twenty Program Demonstration. They have listed twenty projects or programs that are going to attempt to execute by doing in some sense what we just talked about. That was all signed out in late February. That's going to hit the street soon. We are going to see some prototyping of this idea show up within the real world here soon. The next chart:

SLIDE #2

The second thing that we recognized was a monumental cultural problem. That really we have been sort of indoctrinated with building custom systems for the military and that in order to turn it around we have got to attack the work force training and education problem. Here we are talking about implementing a very intensive training program. The Section 824 referred to there, I believe, is in the 1988 Authorization Bill which laid on DoD a requirement to do this kind of training. However, we are feeling that it has to be expanded considerably to cut across the totality of the acquisition process and the acquisition force. The way they wrote 824 it did not seem to drive that hard. We definitely want to see the users and requirement generation people put into training where now it is only contracts, PM and other acquisition people being trained. We would like to see that change in focus. Really what we are driving for is educating everybody on the techniques and approaches to deal with making acceptable commercial products in the military application. We are also making a small plea that we standardize what we do here toward a purple DoD world as opposed to letting it take on too much individuality by each of the services. The next chart:

SLIDE #3

We ended up with four slides (ie., items) but I will just cover three in the interest of time. This third one is kind of interesting because as we stopped and thought about it a little bit we realized that we did not really see any major incentives for government or industry to pursue commercial practices. We could see at the very high level of government the payback at the bottom line or bang for the buck in the decreasing budget. We could see that motivation, that incentive, very clearly but when we get down inside the bowels of the acquisition organization it is hard to find incentives on the government side that say, "Hey, we really want to go and make this happen." So the idea there under the government heading, of capturing a portion of the funds and schedule savings some way for the PEO, PM's group to, in effect, create a little flexibility for themselves or have a little management reserve is an interesting idea that came out. We think that the whole idea here, of the acquisition of best value bears heavily on this. If we could provide that kind of flexibility for sure as opposed to having to defend why not lower cost all of the time, then we might find a little more government incentive.

On the industry side, the one biggie up there is commercial pricing. That means in effect that your customer buys for price and the value that he gets for that price. Not what the heck is the cost base behind it. If you can avoid the fatality of having to go back in to defending and developing all your cost information that we painstakingly and laboriously go through now when contracting with the government, we feel that would allow some recoup of higher ROI's. Clearly the concept of commercial pricing is not a new one. In the 824 I referred to a moment ago, Congress suggested that DoD look a lot harder at providing an exemption from standard FAR type costing backup data and to lower the threshold. Today it is 55%. If your business base is 55% commercial, you can qualify for a pricing backup exemption or costing exemption. We are trying to lower that to 35% which would offer a much broader spectrum of products. We would like to see some way, I don't know quite how to do it, to encourage advanced technology investments that are driven toward both commercial and the government's needs or defense needs. An while we see that as a tremendous incentive, it would be an incentive we are not quite sure how to make happen. Thank you. We will skip the last chart #4.

WORKSHOP #1

Slide #1

BALANCING COMMERCIAL/GOVERNMENT
WORKSHOP #1

PROBLEM (1)

TOTAL ACQUISITION & EXECUTION PROCESS IS TOO COMPLEX

RECOMMENDATIONS:

- SIMPLIFY TO EMULATE COMMERCIAL
  - GET REAL USER NEEDS & REQUIREMENTS RIGHT
  - CONTRACTS, SPECS, CAS, DATA RIGHTS, WARRANTY, ETC
  - ASSURE SUPPORT USER NEEDS
  - MANUFACTURING PROCESSES - PROCESS CONTROL VS INSPECTION
  - QUALIFIED SUBCONTRACTORS ALA TQM CONCEPTS
  - DoD 20 PROGRAM DEMONSTRATION COMMITTED

Slide #2

BALANCING COMMERCIAL/GOVERNMENT
WORKSHOP #1

PROBLEM (2)

LACK OF EDUCATION/TRAINING FOR ACQUISITION FORCE

RECOMMENDATIONS:

- IMPLEMENT A STRONG TRAINING PROGRAM
  - BASE ON SEC. 824 BUT EXPAND TO ALL ACQ. PROGRAMS
  - ADD USER & REQTS. GENERATION PEOPLE
  - CONTRACTS, PM, OTHER ACQ. PEOPLE
  - ACCEPTABILITY OF COMMERCIAL PROCESSES
  - STANDARDIZE (TRAINING) AMONG SERVICES

Slide #3

BALANCING COMMERCIAL/GOVERNMENT
WORKSHOP #1

PROBLEM (3)

NO INCENTIVES FOR GOVERNMENT OR INDUSTRY TO PURSUE COMMERCIAL PRACTICES

RECOMMENDATIONS:

INDUSTRY
- COMMERCIAL PRICING
- RECOUP HIGHER ROI
- ENCOURAGE ADVANCED TECH INVESTMENTS

GOVERNMENT
- MORE BANG FOR DOLLARS IN DECL. BUDGET ENVIRONMENT
- CAPTURE PORTION OF FUNDS/SCHEDULE SAVINGS
- ACQUIRE BEST VALUE

Slide #4

BALANCING COMMERCIAL/GOVERNMENT
WORKSHOP #1

PROBLEM (4)

WHO HAS RIGHTS TO TECH. DATA?

RECOMMENDATIONS:

- ASSURE PROTECTION OF INTERNAL PROPERTY AT PRIVATE EXPENSE
- REVIEW DATA RIGHTS REQTS. FOR REPROCUREMENT
- FORM, FIT, FUNCTION WITH FULL TECH. DATA AT INTERFACE

MR. WILLIAM JONES - Workshop #2 - **Preventing the Waste of Human Resources**

I am Bill Jones. We had the people problem - preventing the waste of human resources. We had the MIT report as our base; we focused in on the human resources neglect and the training and education issues. We kept ourselves pretty much to the industrial setting. We revisited history on productivity improvement and the efforts by management to get the employees to be more productive and all the techniques that were involved with that. We identified that problem in three broad areas and developed a simplified formula which is on the screen now:

SLIDE #1

This is simplifying all the strategies and all the theories into a simply formula that says that performance is equal to the knowledge and skill multiplied by attitude divided by the environment. The attitude came out very important. The environment includes everything - management techniques, tools, etc. In identifying this as a strategic process for human resources we felt that if we could use the formula as a test on the past history and a test on the future we might conclude a strategy. So we identified twenty-five wastes of human resources today through our group thinking. Next slide please:

SLIDE #2

This summarizes the top five issues that we recognized in our brainstorming under the three categories of our formula. We have a lack of vertical saturation of training in organizations. In other words it stops somewhere in the middle and we try another technique conked out and another technique conked out. Most times it never reaches the people where it really matters. We expect it by osmosis to go all the way to the bottom. We looked at those factors under our three factors and you can see environment was the leading issue here. We looked at the lack of understanding of the big picture of the processes of the company and, again, we had to include all three factors. Poor use of training and of trained people was another issue that came out. Cultural lack of appreciation for skills training. The idea that if a person does not have a BS degree he can't contribute. He doesn't have a say. Failure to share training to get the effect of ROI on training. People don't share their briefings when they come back from seminars - sort of an expert power attitude. As you can see we concluded on that chart just by some rough count that 50% of the problem is environment, 30% is attitude of the people and then there is knowledge and skills that are lacking in industry. This is just very general. Who is responsible for these three areas? Well, we think management and supervision is responsible for the environment - at least that industrial work environment. We feel that the employee is a significant stakeholder in the attitude and perfection of it and we need to convince those people through policies and correct communication of the policies that they are responsible and they need to be committed and they need to share in the cost. The cost of solving all this problem is significant. The prescription for one person who needs training -they say that a person who is untrained and trying to use a computer is nine times less effective than those who are trained to be able to use it. So that is sort of a summary of the problem. It is a significant cost in managing the investment, the capital and then monitoring the spending of that cost is the key thing that management and training directors and personnel people worry about.

WORKSHOP #2

Slide #1

DEFINITION OF FORMULA

$$P = \frac{(K \& S) \times A}{E}$$

PERFORMANCE

KNOWLEDGE

SKILLS

ENVIRONMENT

ATTITUDE

Slide #2

	K & S	E	A
LACK OF VERTICAL SATURATION OF TRAINING	10	80	10
LACK OF UNDERSTANDING OF BIG PICTURE OF COMPANY PROCESS	40	40	20
POOR USE OF TRAINING AND OF TRAINED PEOPLE	20	40	40
CULTURAL LACK OF APPRECIATION FOR SKILLS TRAINING	10	50	40
FAILURE TO SHARE TRAINING--GET EFFECTIVE ROI	10	30	60
	20	50	30

MR. LEROY JACKSON - Workshop #3 - **Developing and Validating Capital Needs for Modernization**

Good afternoon. My name is LeRoy Jackson and I was workshop #3 - Developing and Validating Capital Needs for Modernization. Just the one slide please:

SLIDE #1

First of all the issue was the need to understand total, and the emphasis being on total, profit capability and the relationship to specific technical and managerial requirements. We put the emphasis on the word "total" because what we are concerned about is that people not immediately begin to focus on process capability as it relates to going out and charting a manufacturing process per se but inclusive in that is also knowing what the capability is of your organization from a people perspective. In other words getting the people involved, finding out what their capabilities are, what they can contribute to you and your environment as it relates to focusing on the issue at hand. Basic recommendations require that statistical based concepts be used to characterize profit capability in order to prioritize requirements. Basically, what we are saying is that we have to become more astute in using statistical concepts that goes beyond, again like I said earlier, just charting. Other problem solving techniques and tools that are handily available are regression analysis techniques, cause and effect diagrams, pareto charts, and histograms. Any one of these tools can basically help you solve a problem, be that a manufacturing problem, be that a people problem, be that a paper flow problem, whatever the case is.

What we are looking for finally is that modernization does not always equal buy new. In other words, if you have these concepts in place and you use them properly you will know how to apply, maybe even in some cases, a very simple solution. A simple fix if you will which will not only elongate the life, give you better quality in productivity and efficiency but at the same time save as it relates to capital investments. Thank you.

WORKSHOP #3

Slide #1

TOPIC: DEVELOPING AND VALIDATING CAPITAL NEEDS FOR MODERNIZATION

ISSUE: NEED TO UNDERSTAND TOTAL PROCESS CAPABILITY IN RELATIONSHIP TO SPECIFIC TECHNICAL AND MANAGERIAL REQUIREMENTS.

RECOMMENDATIONS: REQUIRE STATISTICAL-BASE CONCEPTS BE USED TO CHARACTERIZE PROCESS CAPABILITY IN ORDER TO PRIORITIZE REQUIREMENTS.

- MODERNIZATION DOES NOT ALWAYS • BUY NEW!!

DR. JACK REVELLE - Workshop #4 -**Integrating Statistical Thinking**

I'm Jack Revelle. I am Chief Statistician of Hughes Aircraft Corporate Headquarters in Los Angeles. My workshop was entitled: Integrating Statistical Thinking With Other Improvements. Let me outline for you some of the things that we did in our workshop before we proceeded to summarize our material for presentation to this audience. To begin with we used a thing called an infinity diagram, one of the 7M tools, the 7 management and planning tools which are the building blocks of quality functional deployment to help us to generate a description of what total quality management includes. Some of the ideas that we came up with included management processes, people, education and training, etc. No big surprises, but we got a lot of buying and a lot of ownership within our group as a result of this particular process. Then we reviewed the components of the variability reduction process, VRP, which includes, of course, quality function deployment, design of experiments and statistical process control and how they relate to each other as well as a number of other improvement strategies. Lastly, we moved on and differentiated between statistical quality control and statistical process control and made it very clear that they were different not only in terms of where they were applied but the reasons that they are applied. Finally, for purposes of summarization I ask for the viewgraph please:

SLIDE #1

We defined what we believe to be our major problem. And that is a lack of application of generally accepted statistical and analytical tools and practices. And after some, I would say, rather heated discussion, not mean but heated, what we came up with some potentially long and short term solutions. As you can see they are integrated statistical and analytical methods into our formal educational process - primary, secondary, post secondary, public and private, military and nonmilitary schooling - to integrate these statistical analytical methods into our management cultures and finally into the entire acquisition process. Now, we didn't solve all of our problems obviously. At this point we could take each of those three solutions, use a cause and effect analysis and with a fishbone diagram, and then take them several levels further than we did in order to figure out how are we going to integrate these statistical analytical methods into our formal educational process as well as our management cultures and our entire acquisition process. That is something that takes more than just an afternoon workshop. It might take an entire day!

I think we had a really spirited group. There were about a dozen of us. It was thoroughly enjoyable. I think that not only did everyone have a good time but, in addition, there was a lot of learning that went out. Do we have any questions on any of the material that I just brought up? There being none I will turn it over to Ms. Spencer.

WORKSHOP #4

Slide #1

PUTTING STATISTICAL THINKING INTO THE ACQUISITION PROCESS

PROBLEM: A LACK OF APPLICATION OF GENERALLY-ACCEPTED STATISTICAL & ANALYTICAL TOOLS & PRACTICES

SOLUTION: INTEGRATE STATISTICAL & ANALYTICAL *METHODS INTO:*

1. FORMAL EDUCATION PROCESS (all levels)
2. MANAGEMENT CULTURES
3. ENTIRE ACQUISITION PROCESS

MS. LINDA SPENCER - Workshop #5 - **Balancing Short-Term Financial Goals with Long-Term Investment Requirements**

We have one slide. I am Linda Spencer with TRW, Inc. and this was Workshop #5 which was Balancing Short Term Financial Goals with the Long Term Investment Requirement. Basically we focused on two different topics. The first was the clear need to utilize incentives to lower the cost of capital. Some suggestions that the group put forth included: faster write-off of plant and equipment, reducing the double taxation of corporate incomes, two of the principal ways to do this were to end double taxation of dividends and to reduce or eliminate taxation of capital gains. Another important impediment of the current U.S. tax structure is simply that it changes so often. With tax laws changing every two years we felt that this was an unnecessary risk to business and hampers their ability to plan long-term.

The second major topic of the workshop that we had looked at was cost based pricing issues. In some current policy does not reward efficiency and is counterproductive. Specifically, there was much discussion in our workshop on defense department segmentation policy and procurement policy whereby each system must maintain total capability without the option of equipment sharing among projects. The result is a serious problem of idle capacity which will only get worse as defense department funding and projects are cut back. Group members highlighted the fact that the market just does not operate this way. The commercial sector thinks in terms of groups and niches and allocates its infrastructure accordingly. Another concern with also came up at one of the earlier panels was the issue of commercial pricing. That what is really important is a quality product at a good price and not a real focus on some of the other issues such as just how much profits are being made. That should not be the key issue. Thank you.

WORKSHOP #5

Slide #1

WORKSHOP 5

TOPIC: COST OF CAPITAL
ISSUES:

- TAX POLICY
- TAX POLICY STABILITY

TOPIC: COST-BASED PRICING
ISSUES:

- SEGMENTATION INCREASES TOTAL COST
- INVESTMENT POLICY VS GOV'T AUDIT PRACTICES
- INCREASED PRODUCTIVITY VS IDLE CAPACITY

MR. RICHARD ENGWALL - Workshop #6 - **The Industrial Modernization Program**

I am Dick Engwall from Westinghouse Electronics Systems Group, the manager of IMIP and Mantech Programs. We covered IMIP in Workshop #6. May I have the first slide please:

SLIDE #1

We had sixteen participants which was one of the larger groups. The group had representatives from all three services, DoD and industry. We brainstormed 27 issues or problems with the IMIP process as it fit into the total management structure and ended up reclassifying these into five major categories. Number one priority is the IMIP objective issue. What is the IMIP objective? Has it migrated, as many of us concluded, into more of a cost reduction tool and its real focus needs to be a restated? We recommend the objective should be to motivate cost effective modernization investment at all tiers. The major objective is to actually improve the industrial base. This does not completely correlate to the present cost reduction goals. With a declining defense base, DoD needs to provide an integrated investment strategy and show how IMIP ties in with Mantech, IR&D and the company's investment and needs. Frankly, we need to provide a simplified, quantifiable measure of IMIP's success. One of the major problems with IMIP has been its apparent sole relation to cost reduction. The second slide please:

SLIDE #2

The second category that we had was administration. We found that the two main issues under that were both focused on the source selection process - What is the IMIP impact? How is it used in the administrative process? We must clarify that impact of IMIP. Are PSR's included or not included in the price for dual sourcing or competitive pricing? Secondly, the product-process conflict. And this was a major issue that came out. We need to determine the most effective way between program implementation versus process implementation. Some things apply in one way and some things apply in another way. Right now it is strictly program focus and that happens even within the companies and within the DoD or services. This happens because different people monitor and influence and direct programs versus those who determine the process. And frankly they are in conflict with each other. The third chart please:

SLIDE #3

Thirdly is education. It is no secret that there is a lack of education on the topic of IMIP in the whole acquisition community including senior executives. We know that those who work with the issue every day, the IMIP managers in the government, know what is going on. But you can't do IMIP without interfacing with the contracting people, the program management people, the finance people, and the management people, as well as the users. We need to examine and provide for a joint government/industry effort. This is very critical! Part of the problem is to jointly understand how to have a win/win scenario with IMIP both at the acquisition process and executive levels. Next please:

SLIDE #4

We also said that cost benefit analysis is basically difficult, cumbersome, and not easily validatable. In fact, we spent a lot of time on this but when we came back to look at our recommendations, we said that part of the problem goes back to, "What is the objective of IMIP?" If we fix what the objective of IMIP is, some of the issues associated with cost benefit analysis will be minimized.

We went on to relate the benefits of IMIP to the new stated objective and we found that cost benefit analyses at the SF 1411 level are appropriate to estimate a contract price. Last:

SLIDE #5

We then looked at the IMIP process itself and found the remaining issue was data rights and intellectual property. Our recommendation was that these really ought to be external to IMIP. We must assure that the solution does not interfere with the modernization process. Right now there are certain deliverables that are required that sometimes interfere with this process. Thank you.

WORKSHOP #6

Slide #1

TOPIC #1: IMIP OBJECTIVE

ISSUE: OBJECTIVE NEEDS RESTATEMENT

RECOMMENDATION FOR STATEMENT

- MOTIVATE MODERNIZATION INVESTMEN (COST EFFECTIVE) AT ALL TIERS
- "IMPROVE INDUSTRIAL BASE"
- PROVIDE INTEGRATED INVESTMENT STRATEGY
- PROVIDE SIMPLIFIED QUANTIFABLE

Slide #2

TOPIC #2: ADMINISTRATION

1. ISSUE: SOURCE SELECTION PROCESS IMIP IMPACT

   RECOMMENDATION:

   - CLARIFY SOURCE SELECTION IMPACT ON IMPACT

2. ISSUE: PRODUCT/PROCESS CONFILICT

   RECOMMENDATIONS:

   - DETERMINE MOST EFFECTIVE WAY

Slide #3

TOPIC #3: EDUCATION

ISSUE: LACK OF EDUCATION ON TOPIC IN ACQUISITION COMMUNITY (INCLUDING SENIOR EXEC.)

RECOMMENDATION

- EXAMINE + PROVIDE FOR JOINT GOVT/INDUSTRY/ACQUISITION OFFICIALS AT THE EXECUTIVE LEVELS

Slide #4

TOPIC #4: COST BENEFIT ANALYSIS

ISSUE: COST BENEFIT ANALYSIS IS DIFFICULT AND CUMBERSOME

- NOT EASILY VALIDATABLE

RECOMMENDATIONS

- RESTATE IMIP OBJECTIVE
- RELATE BENEFITS TO OBJECTIVE
- COST BENEFIT ANALYSIS AT SF 1411 LEVEL

WORKSHOP #6

Slide #5

TOPIC #5: PROCESS

ISSUE: DATA RIGHTS + INTELLECTUAL PROPERTY

RECOMMENDATION:

- EXTERNAL TO IMIP BUT MUST INSURE THAT SOLUTION DOES INTERFERE WITH MODERNIZATION

MR. NICK LAMBIASE - Workshop #7 - **Flowing Policy Down to Suppliers?**

My name is Nick Lambiase. I am from Texas Instruments and I have Workshop #7 on Flowing Down Policy to Suppliers? I would like to thank the people who participated, particularly, Jack Johnson and John Leonard who were very, very active. You all know Jack Johnson from this morning but he had further input specifically to us. The instructions were to come up with no more than two slides which we did and to have some kind of work plan which we also did. And the reason I tell you that first is because when I show you what our recommendations are, I think it will illustrate the point. Please put up the slide:

SLIDE #1

We came up with two things and one of them is the question; "Should IMIP be passed down to subcontractor?", the basic answer is: "Yes, it should be passed down but do not require a flow down. They need to have access to that program without filtering it through a whole lot of background paperwork, reports and other things. They need direct access to that program.

The second part was concerning the source selection and how it is done. Part of this, I think, was just addressed; but source selection needs to be done on a rating system that is based on performance criteria. I know right away people jump on that and start making lists and charts and graphs and putting down numbers and all sorts of things and that really isn't the point. Performance is measured in all kinds of ways depending on what the specific objective is. If the objective is to have higher volume, well that takes one set of criteria. So the message once again is to have a performance criteria that is reactive to the situation at hand; not some federally or other group mandated device that has all sorts of little charts to go check off and say, "Aha! That guy wins, give it to him." That's not the point. I gave an illustration of that during the workshop. We had a pretty significant internal one that we did with our company. We asked people to propose to us how they would accomplish this specific objective which is a very complex part. And it was judged on the quality of the response. We had a panel that judged the answers. We did not have a traditional RFP in the sense that people go out and say, "Here are all the specs and so on, do this, do this and come back and measure these twenty-five points. Does it or doesn't it meet the requirements." The answer was, "I need this device to be this shape and this size and have these characteristics and it has to weigh less than a certain amount. Now tell me how you would do that." We had a creative response from several suppliers. The combination of performance factors with the cost was the evaluating criteria. So it was very flexible. That's a message, I think that will be hard to swallow. The reason I saved that for last is that one of our criteria for today was, when we were sent our letters, it said this is how we are going to work the plan today and we put down thirty minutes for this and twenty minutes for that, and so on. As it turned out we spent about 75 minutes on the first part, about 5 minutes on the second part and 1 minute on the last and we still accomplished the objective. As a matter of fact we exceeded our objective to have two slides; we had one slide with two objectives on it. So it can be done and if you set arbitrary criteria in the front end and force yourself to stick to them, you are almost always going to get the wrong solutions. Thank you.

WORKSHOP #7

Slide #1

WORKSHOP #7
POLICY FLOW DOWN

ISSUE: SHOULD IMIP BE PASSED DOWN TO SUBCONTRACTORS

SUGGESTION: DON'T REQUIRE FLOW DOWN. CREATE A MECHANISM TO ALLOW SUBCONTRACTORS TO PARTICIPATE DIRECTLY WITH DOD.

ISSUE: SOURCE SELECTION. VENDOR RATING SYSTEM

SUGGESTION: BASED ON PERFORMANCE CRITERIA IN RFP

MR. BRUCE LEPISTO - Workshop #8 - **Are Industrial Networks and Product Data Exchange the Future?**

Our goal is to transition both DoD and the defense industry from paper-intensive product development and support processes to highly automated and integrated operations. In meeting that goal, we have an industry and DoD infrastructure development problem, as well as a technology development problem.

SLIDE #1

The capabilities we need come under the headings of Enterprise Integration, Standards for Product Definition, and Integrated Information Services. together, they address the question: How do we (government and industry) put in place the capabilities that are needed for teams of companies and government organizations to work together, using new tools, and new approaches for information management and information use?

In the CALS (Computer-aided Acquisition and Logistic Support) Office, and in the CALS program, we have interlocking initiatives that deal with each of these three areas, but the problem itself is a massive problem. It is a very complex and very hugh problem -- a theme has recurred throughout our Panel's discussions. We continually came back to an unstated question: "How big is our ocean,, and how small is our boat! And how are we ever going to come to grips with all of the issues that this problem raises?"

SLIDE #2

This chart shows the three basic issues we wrestled with.

: Part of the "how big our ocean, how small our boat" question is the interlocking nature of technology issues and culture change issues. In very basic terms, we have rapidly changing technology chasing, and being chased by, more slowly changing culture. the recommendation summarized here is certainly over-simplified, but it reflects the idea that we have different parts of our total community -- government, industry, and academia -- that are primarily responsible for dealing with different aspects of this Catch-22 situation. We'll return to this idea in the next slide.

: The second dimension of the problem is ownership. Who owns this massive transition problem? Certainly, it is too simplistic to say that we all own it. In fact, we (government, industry, academia) each own different dimensions of the problem, and have different perspectives and interests to bring to bear on it. First, in terms of which issues within the total problem concern us. Second, in terms of which parts of the problem have to be addressed in very different ways. Each of us has primary responsibility for, and interest in, different parts of the overall problem. Sorting out those pieces and their inter-relationships is itself a very complex problem that our panel tried to address, with only limited success.

: Lastly, we dealt with the question, "what is the proper role of government?" That is, what should the role of government be in dealing with the infrastructure development issues facing us? It was the general view of the Panel that the principal role government should play is to "get out of the way." Government should take away the inhibitors and certainly should continue to do the facilitating and incentivizing tasks that a number of our organizations are attempting to do. But the number one priority for government is just to get out of the way.

SLIDE #3

Our Panel came up with the set of specific issues shown here. For the moment, set aside the columns on the right hand side of the chart, and let's discuss the list of issues. At one point, we tried to prioritize these issues, until we finally decided that you really couldn't work the problem without addressing all of these issues (and, in fact, probably a number of others that we never had a chance to get to).

: Issue #1 is the affordability issue. How do we bound the problem so that it can really be dealt with? Not just "who pays?" but how do we define the task so that it can be addressed economically?

: Issue #2 is the complexity issue. The technology required, and standardization of that technology, is becoming increasingly abstract -- increasingly difficult to both deal with, and even comprehend.

: Issue #3 is the vision issue. How do we look beyond the things that we are doing for the near term, and see where we are going for the long term?

: Issue #4 is the coping issue. How broadly do we define the information that is managed and shared and exchanged within the concept of industrial networking?

: Issue #5 is the evolution issue. How do we incorporate new technology and continue the transition process, without either "plateauing" until the next major technology shift, or starting over with all the consequent duplication of time and scarce resources?

: Issue #6 is the participation issue. How do we get broad involvement in addressing the problem, and broad participation in defining the appropriate solution(s).

: Issue #7 is the control issue. How do we manage information, provide access to the right users, and withhold access from the wrong people?

: Issue #8 is the visibility issue. The technology itself will be providing tools that will allow any of you -- or any of us -- to have a great deal more visibility about users and their information, a concern we all share.

On the right hand side of the slide, we tried to identify whether these issues are of high, medium, or low interest to our three broad communities: government, industry, and academia. You will notice that in the government column and in the industry column -- with one exception, which was a last minute change I'm not sure we all agreed with -- these are all high interest issues.. They are issues of significant concern to both government and industry.

I would suggest to you, that the common perception of the people on our Panel that these issues are -- by and large -- of low interest to academia, is itself an issue. that relates back to the first fundamental issue that appeared on the previous slide. There, we talked about the relationship of culture and technology, and the leadership role that academia should play in facilitating cultural change. The common perception that academia is not really interested in, or a participant in solving, most of these issues, is itself a serious concern.

Slide #1

INDUSTRIAL NETWORKS AND PRODUCT DATA EXCHANGE

OBJECTIVE:
Reduce costs and time for industry to implement integrated computer systems to facilitate the process improvements needed to improve quality and productivity, and maintain competitiveness.

- ENTERPRISE INTEGRATION FRAMEWORK
- PRODUCT DEFINITION STANDARDS
- INTEGRATED INFORMATION SERVICES

Slide #2

INDUSTRIAL NETWORKS AND PRODUCT DATA EXCHANGE

ISSUE - INTER-RELATIONSHIP OF CULTURAL CHANGE AND TECHNOLOGY CHANGE
RECOMMENDATION - LEADERSHIP BY ACADEMIA IN FACILITATING CULTURAL CHANGE, BY INDUSTRY IN MANAGING TECHNOLOGY CHANGE
ISSUE - PROBLEM OWNERSHIP
RECOMMENDATION - SHARED PROBLEM UNDERSTAND
DIFFERENT INTERESTS:
0 GOVERNMENT
0 INDUSTRY
0 ACADEMIA
ISSUE - ROLE OF GOVERNMENT
RECOMMENDATION - DEFINE CHANGE TO ELIMINATE ROADBLOCKS, FACILITATE/ENABLE APPLICATION OF INCENTIVES

Slide #3

INDUSTRIAL NETWORKS AND PRODUCT DATA EXCHANGE

ISSUES	G	I	A
1 HOW DO YOU WEIGH COST OF PROBLEM VS COST OF THE SOLUTION? (i.e. WHO PAYS?)	H	H	L
2 PROCESS OF GENERATING STDS	H	H	L
3 WHAT IS NEEDED BEYOND CURRENT TECHNOLOGY?	H	H	H
4 CLASSIFICATION/PRIORITY OF DATA?	H	H	L
5 HOW TO ALLOW SYSTEMS TO EVOLVE AS NEW TECHNOLOGY IS AVAILABLE	H	H	H
6 HOW TO INCENTIVIZE EVOLUTION OF OPEN ARCHITECTURE?	H	H	H
7 ACCESS TO NETWORK - COST, SECURITY, CONTROL	H	H	L
8 GOV'T ACCESS TO LOWER TIER VENDORS	H	M	L

MR. BRIAN WRIGHT - Workshop #9 - **The Use of Multifunctional Development Teams**

We had the problem of addressing concurrent engineering or the use of multi-functional engineering teams. If I could have the first chart:

SLIDE #1

We basically had twenty-four problems that were gathered from the group. The group was twelve people in number. We reduced them to three basic issues. The first basic issue here is, "How to encourage excellence without legislation." And the reality of the situation is how do you keep the government contracting organization from implementing concurrent engineering as a requirement within the contract. Basically, we felt that the contracting structure needed to be facilitated to allow TQM principles to be put in place on the contract without requiring it as a direct mandate. We were also extremely interested in the fact that there either should be work on the government side to remove disincentives that currently exist or are perceived to exist within the FARS and DFARS. A pre-contract major issue was made within the government side of the working group. They wanted to have access to the customer's facility to actually go in and see and visually touch and feel the fact that the contractor is actively involved in concurrent engineering rather than reading a brochure that was prepared by a third party of how they were going to do it. In a light fashion, the contracting folks in the workshop felt that they would like to have better access to the customer after the contract. Too often the customer is cut off from the actual design community; and therefore, the customers true requirements are not being felt within the overall design. Could I have the second chart please:

SLIDE #2

This issue sounds like motherhood but we are back to the old issue of how do you remove the cultural and traditional barriers. One of the key points as illustrated up there is the fact that top management must be committed; but another key point that we felt was just as important is the fact that the government should provide incentives for key management to get interest. It is one thing to preach to key management, it is another thing to hang a carrot out there as something to go after. The rest of the ideas basically have been discussed before in many organizations and many forums; but the fact of the matter is that we need to clarify and define responsibilities; accountability is a team effort, it is not an individual, it is not the program manager or the project engineer, it is the team that is developing the product. We felt that there needed to be some additional facilities, and consideration with regard to collocation of personnel that are involved in concurrent engineering. There was a lot of talk about the fact that there should be improved internal and external communications capability. There was also discussion about tools being provided and the shape of CAD, CAM and SIM type environment. And also the issue of equality and equity of compensation with regard to manufacturing and quality engineers as they stack up against the design engineering team. Could I have the last slide please:

SLIDE #3

The final issue is how to establish realistic funding profiles or levels for the actual implementation of concurrent engineering. One of the major concerns here is that you have people that are working in government organizations in the Pentagon or elsewhere that are literally forecasting and establishing funding profiles for the out years. How do they do that? How do they know what the process is that has to be gone through by a group that is involved in concurrent engineering

and what the actual profile should look like in order to fund that at the front end? That process needs to be understood, needs to be studied and I recommend that it be studied very quickly. And then the education needs to be provided to the people who are going to be doing that process before they are assigned to their billets. If that doesn't happen early, anything we talk about with regard to up front funding for concurrent engineering is doomed to failure. Likewise, we though that there was a lot of concern both within industry and some case within the government about the use of industrial, independent research and development funding for the actual process development. We are talking about processes that are being developed for new products but they are manufacturing processes. Many people that are in the community perceived, and in fact there may be, prohibitions against the expenditures of those funds for the development of those processes. We felt that there had to be a consideration for pilots and prototypes within the contracts. To anticipate building the first ten units in a factory and making those units go through a first article test is very, very difficult, if not fatal. There should be consideration given to building pilot units and testing them and learning something and then going back in refining it with a prototype build before you get to your first article units. And finally, the issue of P^3I funding was discussed. There was the feeling that if we consider the movement of P^3I funding from where it is after the product is "type classified" back up front in the program so that we can do a more effective concurrent engineering job, the product at the back end would be more satisfactory. Thank you.

Slide #1

CONCURRENT ENGINEERING ISSUE #1

ENCOURAGE EXCELLENCE WITHOUT LEGISLATION

1. STRUCTURE CONTRACTING PROCESS TO PROVIDE BEST VALUE TO THE CUSTOMER
2. GOVERNMENT SHOULD REMOVE DISINCENTIVES TO APPLICATION OF TQM PRINCIPLES
3. PRE-CONTRACT
   GOVERNMENT SHOULD BE ABLE TO VISIT CONTRACTOR AND MEASURE THEIR COMMITMENT
4. POST-CONTRACT
   CONTRACTOR SHOULD HAVE ACCESS TO "THE TRUE CUSTOMER" TO ENSURE PRODUCT SUCCESS

Figure 1

Slide #2

CONCURRENT ENGINEERING ISSUE #2

ESTABLISHING REALISTIC FUNDING LEVELS

1. STUDY & DEFINE FUNDING PROCESS FOR CONCURRENT ENGINEERING
2. TRAIN PERSONNEL BEFORE ASSIGNMENT TO BUDGETING POSITIONS.
3. REMOVE PROHIBITIONS ON USE OF IR&D FOR PROCESS IMPROVEMENT
4. PLAN FOR PILOTS/PROTOTYPES IN MOST DEVELOPMENTS
5. MOVE P3I FUNDS UP FRONT (VICE LATER) IN PROGRAM

Figure 2

Slide #3

CONCURRENT ENGINEERING ISSUE #3

REMOVE CULTURAL & TRADITIONAL BARRIERS

1. GOVERNMENT SHOULD PROVIDE INCENTIVES
2. TOP MANAGEMENT MUST BE COMMITTED
3. TEAM RESPONSIBILITIES ARE CLARIFIED
4. TEAM ACCOUNTABILITY
5. EQUITY/EQUALITY OF COMPENSATION
6. FACILITIES SHOULD PERMIT CO-LOCATION OF ENGINEERING TEAMS
7. INTERNAL & EXTERNAL COMMUNICATIONS IMPROVEMENT
8. PROVIDE IMPROVED DESIGN TOOLS

Figure 3

DR. DAVID I. CLELAND - Workshop #10 - **What is Needed in Curricula to Cover Industrial Modernization?**

Thank you. We had a good meeting of the education working panel. I think some of them are still over there talking and arguing. I don't have any viewgraphs. I am going to enumerate some of our major conclusions and findings, not necessarily in their order of importance but these all were important to the group. First, the issue of quality in education. The producing of a quality student in the educational system. Second, the need to integrate more industry and education through cooperative programs, through having graduates serve some type of an apprenticeship leading toward practical experience as well as the theoretical exposure within the classroom. Third, continuing education is going to be a greater and greater challenge in the future as we have to keep our employees up to date with the state of the art in their particular technologies. The next point is the importance of work experience and work experience particularly within industry recognizing that we are not an accountant; we're not an engineer; we're not a scientist until we have graduated and been out in the real world for a few years. Another key question that came up concerned what are the incentives for a university to put on excellent programs for industry. Turning out a quality product, of course, would be an incentive; providing the avenue for development of research money coming in and that sort of thing. Another issue is that we do not have enough non-foreign graduate students in the engineering colleges in this country at the present time. We also discussed the role of community colleges and how they are part of the educational system, an important part. Another key issue which we think faces all of us in industry and in the educational community is the lack of leadership in manufacturing managers, and for those managers for whom the manufacturing managers work.

We concluded that technology was not the problem but rather it was the management of technology with respect to education curriculum. In terms of some more specific recommendations, we feel that the management of the enterprise giving due attention to the engineering and technical matters of that enterprise is a critical need in industry and in educational institutions today. We recognize the need for the teaching of such things as ethics, trust, loyalty, team building, interpersonal skills, the ability to function effectively as a member of a team. We recognize that the time available for education must be extended - that four years is not doing the job and this has to be looked at. We see within educational institutions that the management of the curriculum in the face of changing technology and changing knowledge basis is an important consideration. We ask the question, "Who are the real stakeholders in the educational business?" It includes the students, the faculty, local industry users and many, many others. When we look at the educational problems and the educational opportunities, we have to look at these stakeholders. Industry we recognize because it is not having its needs satisfied by educational institutions. In the primary, the secondary and the college level, industry is getting into and will be getting more and more into the educational business.

We then changed the tenor of our deliberations a little bit and we asked ourselves the question, "What should we not do?" We talked previously about what we had decided we should do. And we concluded that we should not think that the educational process is fixed. We also concluded that we should not think that the educational curricula itself is fixed. We also said that industry should not accept a poor quality educational product. Recognizing that they are doing it today and they are instituting their own remedial educational programs. In terms of some specific courses or programs we identified, I will read down the list very briefly to include simultaneous or concurrent engineering, project or program management, team building, communications, software engineering, technological planning, computer graphic expert systems, engineering management and

manufacturing management systems are some that we should be dealing with in the future. Our bottom line of all our deliberation was basically this: that education is a systems business. It is a stakeholder problem. It is not the technology of education that is the real issue but rather the management of that educational technology. Thank you.

WORKSHOP PROCEEDINGS
WORKSHOP # 1

INTRODUCTION

- Balancing The Industrial Modernization Agenda - Commercial & Governmental! - Del Babb, American Defense Preparedness Chair, DSMC, (formerly Program Manager for IBM). Current, common interests of the governmental and industrial customer will be examined. Where one, or the other, leads; ways for satisfying the needs of both communities will be illuminated.

PROCEEDINGS

Mr. Babb distributed an agenda and a set of viewgraphs setting the parameters of the workshop. See attachments. In brief, Mr. Babb's agenda addressed two broad issues for the workshop:

1. The need to change acquisition practices to enhance commercial product use. How we buy!
2. The problems, barriers and issues involved in operating dual use manufacturing for commercial and military. What we buy!

    a. Use of basically a commercial operation for military.
    b. Use of basically a military operation for commercial.

Mr. Babb suggested eight facets of these issues as possible areas of discussion but invited all participants to consider these or any others that they wished to include. His items were:

1. Cost accounting
2. Pricing
3. Specifications & Standards
4. Technical Data Rights
5. Federal Regulations (FAR vs UCC)
6. Supportability
7. Environment Compatibility

Mr. Babb then indicated that the workshops task was to discuss issues, problems and recommendations and select the top priority 3 to 6 topics for sharing with the reconvened whole body at 1630. In further introductory comments, Mr. Babb called attention to the attached items encompassing 1. Legislation SEC. 824 ACQUISITION OF COMMERCIAL AND NONDEVELOPMENTAL ITEMS and 2. A letter from Undersecretary of Defense Mr. John Betti to the House Armed Services Committee indicating that consideration be given to commercial acquisition of 20 selected items.

Mr. Babb then requested that members each indicate their top two items for inclusion in the issues list. The following list was generated and written on large sheets for all to see and follow:

1. Product specs. & stds.
   Preclude single prod. line

2. Educ. & trng. for des. engr. to use comm. items vice perf. specs. (culture chg!)

3. Simplify process to emulate commercial - contracts, cost, specs., warranty,

4. Process specification (unnecessary applied to mil. specs.)

5. Config. control from logistics viewpoint

6. Tech. Data Rights

7. User needs/reqts. (really!)

8. Incentives to go commercial for industry.

9. Incentives for govt. bureaucracy to go comm.

10. Comm. warranties - add'l work on field and admin.

11. Cost acc't. stds.

12. Where is commerce dept in this?

Further discussion regarding these categories resulted in combining 11. with 3. and 8. with 9. Following these changes and further clarification discussions regarding what specifically was encompassed in several others, Mr. Babb asked that each member vote for their top two selections in order to narrow down the topmost 3 or 4 items. The final vote was as follows:

Item	Number of votes
1.	1
2.	3
3 & 11.	4
4.	2
5.	1
6.	2
7.	0
8 & 9.	2
10.	0
12.	1

Further discussion resulted in combining 4. into 3. which resulted in it having the top priority be 3. with 2. second and 6. and 8 being third and fourth.

Mr. Babb, then proceeded to define the problem and recommendations of the top four items utilizing large sheets for all to see and to comment upon resulting in the attached viewgraphs which were then prepared for presentation at the larger reconvened group. The problems identified were:

1. TOTAL ACQUISITION & EXECUTION PROCESS IS TOO COMPLEX

2. LACK OF EDUCATION/TRAINING FOR ACQUISITION FORCE

3. NO INCENTIVES FOR GOVERNMENT OR INDUSTRY TO PURSUE COMMERCIAL PRACTICES

4. WHO HAS THE RIGHTS TO TECHNICAL DATA?

The participants in the workshop are listed in attachment 3.

Mr. Babb adjourned the workshop with by thanking all of the participants for their inputs and thoughtfulness.

SEC. 824. ACQUISITION OF COMMERCIAL AND NONDEVELOPMENTAL ITEMS

(a) IN GENERAL - The Secretary of Defense shall -

(1) prescribe regulation as provided in subsection (b); and

(2) conduct an analysis as provided in subsection (c).

(b) REGULATIONS - (1) Not later than 180 days after the date of the enactment of this Act the Secretary of Defense shall publish for public comment thereto regulations to carry out the requirements in this subsection and rescind any regulations that are inconsistent with the requirement of this subsection. The Secretary shall promulgate such requirements not later than 270 days after the date of enactment of this Act.

(2) The Secretary of Defense shall develop a simplified uniform contract for the acquisition of commercial items by the Department of Defense and shall require that such simplified uniform contract be used for the acquisition of commercial items to the maximum extent practicable. The uniform contract shall include only -

(A) those contract clauses that are required to implement provisions of law applicable to such an acquisition; and

(B) those contract clauses that are appropriate, as determined by the Secretary of Defense, for a contract for such an acquisition. In addition to the clauses described in subparagraphs (A) and (B), a contract for the acquisition of commercial items may include only such clauses as are essential for the protection of the Federal Government's interest in the particular contract, as determined in writing by the contracting officer for such contract

(3) The Secretary of Defense shall require that a prime contractor under a Department of Defense contract for the acquisition of commercial items be required to include in subcontracts under such contract only -

(A) those contract clauses that are required to implement provisions of law applicable to such subcontracts; and

(B) those contract clauses that are appropriate, as determined by the Secretary of Defense, for such subcontract. In addition to the clauses described in subparagraphs (A) and (B), a contractor under a Department of Defense contract for the acquisition of commercial items may be required to include in a subcontract under such contract only such contract clauses as are essential for the protection of the Federal Government's interest in the particular subcontract, as determined in writing by the contracting officer for such contract.

(4) The Secretary of Defense shall require the use, in appropriate circumstances, of a modified inspection clause with streamlined inspection procedures in each Department of Defense contract for the acquisition of commercial items awarded to a contractor that (A) has a proven record of high quality production, and (B) offers an appropriate warranty to protect the Federal Government's interests in acquiring a high quality product.

(5) The Secretary of Defense shall require the use, in appropriate circumstances, of standard commercial warranties in each Department of Defense contract for the acquisition of commercial items.

(6) The Secretary of Defense shall revise the regulations governing the applicability of the exemption contained in section 2306a(b)(1)(B) of title 10, United States Code, consistent with the public interest. In revising such regulations, the Secretary (A) shall address the standards for applying such exemption to contracts and subcontracts for items which are modifications to commercial items, components of commercial items, spare parts for commercial items, new commercial items or commercial items which are no longer sold to the public and (B) shall ensure that cost or pricing data are not required in connection with contracts and subcontracts qualifying for an exemption under the regulations as revised under this paragraph.

(c) ANALYSIS - The Secretary of Defense shall conduct an analysis of impediments to the acquisition of nondevelopmental items by the Department of Defense. In conducting the analysis, the Secretary shall consider, at a minimum, the following:

(A) Whether to expand the regulations governing the acquisition and distribution of commercial products to address the procurement of nondevelopmental items.

(B) Whether revisions to the regulations governing specifications, standards, and other purchase descriptions are necessary to implement the statutory requirement that product specifications be stated in terms of functions to be performed, performance required or essential physical characteristics, and to minimize the use of specifications unique to the Department of Defense.

(C) Whether to establish a presumption that the Department of Defense should not request technical data on commercial items.

(D) Whether the Secretary of Defense should make greater use of the authority granted the Secretary in law to exempt defense contracts for commercial items from the application of various requirements.

(2) Not later than 270 days after the date of the enactment of this act, the Secretary shall develop and submit to the Committees on Armed Services of the Senate and House of Representatives a plan of action for addressing any impediments identified in the analysis required by paragraph (1). The plan shall include a specific schedule for the following:

(A) Rescission of any regulations that are identified as impediments to the acquisition of nondevelopmental items.

(B) Publication for public comment of new regulations to carry out the plan.

(C) Submission to Congress of proposals for such legislative changes as may be needed to carry out the plan.

(d) Training - (1) The Secretary of Defense shall establish a program for training contracting officers, program managers, and other appropriate acquisition personnel in the acquisition of nondevelopmental items.

(2) The training program shall provide, at a minimum, for the following:

(A) Training in the requirements of the regulations promulgated pursuant to this section, the requirements of section 2325 of title 10, United States Code, and regulations prescribed pursuant to that section.

(B) Training of contracting officers in the fundamental principles of price analysts and other alternative means of determining price reasonableness.

(C) Training of appropriate acquisition personnel in market research techniques and in the drafting of functional and performance specifications.

(e) Demonstration Program for Items Issued to Members - (1) The Secretary of Defense shall carry out a demonstration program in accordance with this subsection with respect to the procurement of individual items of clothing issued to members of the Armed Forces. Under the demonstration program the Secretary shall:

(A) identify those items of clothing that are the same as a or similar to clothing items produced by commercial sources for sale to consumers other than the Armed Forces; and

(B) designate for acquisition in accordance with this subsection certain of such items (hereinafter in this subsection referred to as

"demonstration items") as the Secretary considers appropriate for acquisition under the demonstration program.

(2) With respect to a portion (determined by the Secretary) of the contracts for demonstrations items entered into by the Department of Defense, the Secretary shall----

(A) include in the solicitations for such items a specifications reflecting destroys and functional requirements that are comparable to those used in the award of commercial contracts:

(B) require each offeror to submit a sample article of the items:

(C) provide in the evaluation criteria included in the solicitation that award of the contract will be made to the proposal which is most advantageous to the United States considering only cost or price and other factors included in the solicitation;

(D) evaluate come ? proposals either with or without discussions and the sample article received in response to a solicitation for such items and award a contract in accordance with the evaluation criteria included in the solicitation; and

(E) require each contractor awarded a contract for such items to produce items identical in all major characteristics (including quality) to the sample article submitted with the contractor's bid or proposal.

(3) The demonstration program required under this subsection shall apply with respect to solicitations for demonstration items covered by the program issued after the end of the 180-day period beginning on the date of the enactment of this act and before October 1, 1993.

THE UNDER SECRETARY OF DEFENSE
WASHINGTON, DC 20301

ACQUISITION

16 FEB 1990

Honorable John R. Kasich
Committee on Armed Services
United States House of Representatives
Washington, DC 20510

Dear Congressman Kasich:

As a result of your discussion with Deputy Secretary Atwood in December 1989, I have directed a commercial acquisition demonstration program. I have selected 20 items for this program which vary in complexity and nature. Currently, all of these items are procured using a military specification. We believe that these items will provide a good test of our ability to procure a wide variety of items on a commercial basis.

The appropriate military specifications will be converted to commercial item descriptions. We may find that there are inhibitors to commercial procurement that are beyond our control and require additional congressional help. Should that be the case, we know we can count on your help and support.

We believe information gleaned from this exercise will prove valuable in increasing our use of commercial products.

We appreciate your support and interest in an effort we believe can provide great benefits to the taxpayers.

Sincerely,

John Betti

Enclosure

Attachment 2

1. Aircraft pneumatic tire
2. Riot type 12 gauge shotgun
3. Under water team demolition knife
4. Passenger bus
5. Night vision equipment
6. Voltmeter
7. Ship 20 power binocular
8. Navigation radio
9. Generator set
10. Survey target set
11. Life preserver
12. Military police belt
13. Variable resistor
14. Heat pump
15. Paint spray guns
16. Examining table
17. Aural sound protectors
18. Extreme cold weather undershirt
19. Woman's acrylic sweater
20. Candy and chocolate confections

NOTE: Items may change. In some cases, it may be necessary to substitute similar items if requirements changes affect projected procurements.

PARTICIPANTS

WORKSHOP #1

BALANCING THE INDUSTRIAL MODERNIZATION AGENDA - COMMERCIAL AND GOVERNMENTAL - Del Babb/Gary Richard

1. Jerry Norley
   Motorola
   Scottsdale, AZ

2. Joe Syslo
   United Technologies Corporation
   Washington, DC

3. Joseph Hering
   PM^2
   Reston, VA

4. Leo Plonsky
   Naval Industrial Resource Support Activity
   Philadelphia, PA

5. Richard Heroux
   Air Force Systems Command
   Hanscom AFB, MA

6. Harold Rife
   Naval Weapons Support Center (NWSC)
   Crane, IN

7. Bob Jenkins
   P.M. NAVSEA
   Crystal City, VA

Attachment 3

WORKSHOP PROCEEDINGS
WORKSHOP # 2

INTRODUCTION

- **Preventing The Waste Of Human Resources** - William Jones, Director, Training & Communications Development, Federal Systems, Eastman Kodak Corp. Rapid technical advances and the declining educational preparedness of industrial workers has established a need for new training strategies and initiatives regarding human resource development. The benefits and costs to improve organization's competitive stance will be discussed.

PROCEEDINGS

The initial thesis of this workshop was that rapid technical advances and the declining educational preparedness of industrial workers has established a need for new training strategies and initiative regarding human resource development. This thesis was explored by the participants and specific issues and solutions were discussed, including their benefits and costs for improving an organization's competitive stance.

The work group considered the MIT Commission report on Industrial Productivity as it pertained specifically to education and training, the neglect of human resources, and policy recommendations regarding education and training. After a brief discussion by the workshop leader summarizing the history of the many attempts by management to increase worker productivity in American organizations, it was agreed by the group that we needed to look at human resource wastes today to derive a strategic approach to preventing wastes in the future. Another premise included the assumption that any strategic formula for preventing waste should include consideration of two basic variables in addition to consideration of the knowledge and skill requirements to become more productive: 1) the work environment, and 2) the attitude of employees. The logic is that a fully trained employee in a poor work environment or one who has an inappropriate attitude can still perform poorly or be noncompetitive.

The work group participants brain-stormed a list of 25 issues that affect the effective use of human resources in American organizations today. Then, through a multi-voting process, prioritized the list to come up with their interpretation of the most critical issues to be addressed.

The five critical issues in priority order were:

Lack of vertical saturation of training

Lack of understanding of the big picture of the processes in the company.

Training not used; poor use of training people; misapplication; sending people to the wrong training; check the block training.

A cultural lack of appreciation for skills training.

Failure to recognize training/education as an investment.

Each of these issues was then evaluated in a matrix in terms of how much of the cause was affected by a lack of knowledge and skills, how much by the environment, and how much by attitude. The result of that analysis is shown below:

	Knowledge & Skills	Environment	Attitude
Lack of vertical saturation of training	10%	80%	10%
Lack of understanding of big picture of the processes of company	40%	40%	20%
Training not used; poor use of training people; misapplication; etc.	20%	40%	40%
Cultural lack of appreciation for skills training	10%	50%	40%
Failure to recognize training/education as an investment	10%	30%	60%
Averages	18%	48%	34%

Because of this analysis and the weighing of the basic variables, the group concluded that the work environment and attitude of employees attribute to approximately 80% of the problem involving human resource waste as it pertains to education and training. Therefore it follows that strategic plans to prevent wastes need to have considerations of improvements in the work environment (e.g.: management, tools and techniques, facilities, organizations, reward systems, etc.) and in the attitude of workers towards work, competition, change, teams, groups, continuing education, etc.

To prevent waste of human resources and achieve greater productivity there needs to be more partnerships formed where responsibility for training and education is shared, but recognizing that management has the primary responsibility for establishing a productive work environment and the employee has the primary responsibility for developing the proper attitude towards education and productivity at work.

It is also recognized that the training and education required to regain American industry's competitiveness is very costly. The cost of a single prescription for an individual employee that needs updating or to be retrained is significant. This is why many managers want to dodge the problem or let others sponsor major updating pr retraining efforts. Organizations needed to treat

this cost as a longer term investment, involve all stakeholders (especially the employee) and establish clear plans and policies regarding this investment. The total cost and expenditure of training needs to be estimated, monitored, evaluated over a longer term.

In conclusion, to implement a longer range human resource plan that will prevent human resource waste, it is recommended that organizations:

1) Look critically at their human resource wastes and processes for developing human resources today.

2) Develop a strategic process and plan for developing human resources which prevents wastes. Consider the environmental and attitude variables as well as the knowledge and skill requirements.

3) Involve all stakeholders (especially the employee).

4) Vertically saturate (top to bottom) training of organizational groups. Don't assume waterfall effect will happen.

5) Tie into the process improvements that are taking place in the company. Improve communications regarding company processes and strategic plans.

6) Remove the cultural biases towards skills training. Invest in developing personnel who don't have college degrees.

7) Estimate, monitor, and control training expenditures over the long term. Analyze the total cost.

8) Devise improved ways to measure, verify, and reward good results regarding the effective use of training resources and of trained people.

9) Recognize training and education as a business investment and evaluate the return on investment over the long term.

WORKSHOP PROCEEDINGS
WORKSHOP # 3

INTRODUCTION

- **Developing And Validating Capital Needs for Modernization** - LeRoy Jackson, Manager, Statistical Development, Harley-Davidson, Inc. Too many enterprises cut directly to expensive capital investment strategies as "the way to modernize." This workshop will explore alternate approaches to capital investment for productivity by applying the lessons of successful commercial practices to defense acquisition. These approaches center on completing a review of an organization's TQM management philosophy and control over existing industrial capability prior to buying new capital equipment.

PROCEEDINGS

This workshop was conducted around the premise that future DOD modernization efforts with industry will occur under vastly reduced (or entirely eliminated) budgets specifically identified to incentivize or support desired or needed industrial modernization improvements. The Harley-Davidson turnaround in the Eighties, going from all-but-bankrupt to regain the competitive edge in their industry, was therefore used as a "benchmark" for what DOD and its contractors might do in terms of process modernization as overall defense spending declines.

Harley's recovery story is well-documented. Their market position plummeted from an 87% market share in 1976 to a 22% share in 1981 and then back to one exceeding 60% in 1989. They lost over $30M in an 18 month period during those nadir years. Harley's successful recovery clearly illustrates that quality, productivity, and competitiveness can be established and increased without reliance on expensive capital improvements when those resources are just not available.

Effective modernization strategies begin by satisfying two primary conditions before approving investment in new capital. Both conditions require a total quality management philosophy where all organizational decisions are driven by the cost-of-quality to satisfy customer needs. Doing the fundamental things first is a cornerstone of this philosophy.

The first condition requires senior management to review its overall business strategy to prioritize requirements, and make them clearly known throughout the organization. Simultaneously, upper management must empower and trust the employees who actually perform the work in order to release the energy and common sense of this workforce. Starting here recognizes that the "modernization" of management strategy and philosophy in employing human resources is as important for improving quality and productivity as new capital equipment.

We must take greater advantage of this "people power". Training costs almost always cost less than any other form of modernization investment. Training and education is a massive and continuous activity, but these expenditures should be seen as positive investments with potential for high return, not just seen as sunk cost. In the end, modernizing people productivity may be the only real productivity resource available in the near term of reduced budgets and tight lending money markets.

The second condition requires the maximum use of existing equipment. This condition can only be satisfied through statistical knowledge of process capability and ensuring designs released to be produced on this factory equipment are producible, that is, relate to that process capability. The best way to establish the parameters of this capability is through statistical process control (SPC), designs of experiments (DOE), and other recognized statistical based analysis techniques. In addition, these statistical methodologies can then be employed to relate the process capability to management's prioritized requirements.

This approach ensures valuable operating capability is not wasted on rework and repair because process control is lacking. New equipment will not cure a lack of quality or competitiveness unless the full capability of the older equipment is exceeded. New equipment should be in its "worst" performing condition the day it is delivered from its original equipment manufacturer. Conversely, never buy new capital equipment unless the existing equipment being replaced is in "world class" condition.

Given these first two conditions are fully satisfied, new equipment can now be considered. Considerations must be based on statistical proof that indicates needed product tolerances (validated design requirements) can no longer be produced. These statistics must be clear, visible, mathematically sound and measurable to provide legitimate justification for new equipment investment needed to surpass proper utilization of existing equipment.

To provide for the widest application, capital modernization should also focus on improvement in the general process (high first-pass production yields), not necessarily related to a "specific" solution (program orientation). It is equally clear this entire approach to industrial modernization is absolutely essential at all subtier component vendors and suppliers. Increasing risk and competitive issues at these levels highlight the need for greater technical management focus at the sub-tiers replacing an existing focus on lowest cost and expediting material schedules.

In conclusion, workshop members believe a disciplined three-step approach to industrial modernization is necessary to develop and validate the needs for such modernization. These three steps are:

1. Review management strategies and prioritize business requirements, then take advantage of this people power to get the process moving.

2. Establish full statistical control over existing capabilities.

3. Purchase new capital equipment only when statistical proof exists to justify this expensive decision.

Capital investment strategies for industrial modernization that are not based on statistical proof for justification, or do not involve employees who operate the equipment in the decision process, can only be accomplished the inefficient, hard way. We must exploit all available resources before employing the expensive strategy options. Get employees really involved and use statistics to validate <u>any</u> decision. If no funding is readily available, rely on these simple, easy to do options that improve productivity to free up monetary resources currently used to deal with existing inefficiencies. This "zero-dollar modernization" concept offers an almost infinite leverage to increased quality and productivity if its based on doing all the right things right the first time before resource-heavy modernization strategies are employed.

As in the case of Harley-Davidson, DOD may not have dedicated resources to separately incentivize the modernization programs of our contractors as we have in the past. Under such conditions, we can all benefit from the results of an approach that uses our management strategies, people power, and control over existing capability to the maximum. We have the Harley experience, not only on their commercial business but their DOD business as well, as a benchmark that this approach works.

WORKSHOP PROCEEDINGS
WORKSHOP # 4

INTRODUCTION

- Integrating Statistical Thinking with Other Improvements - Dr. Jack ReVelle, Chief Statistician, Quality Management, Hughes Aircraft Company. The applied statistical techniques championed by Dr. W. Edwards Deming and Dr. Genichi Taguchi are receiving increased attention worldwide in both industry and academia. Many managers believe that variability reduction through the use of designed experimentation and statistical process control is the single best method for improving quality and productivity. Statistical thinking and its relationship to other productivity initiatives will be discussed. Participants will explore how applied statistical methods can best be integrated with existing productivity initiatives within the defense acquisition process.

PROCEEDINGS

The group agreed that statistical and analytical methods (SAM) are important factors in any quality improvement process. The SAMs included by the group were: designed experiments and statistical quality/process control. The latter is made up of Pareto analysis, cause and effect analysis, run charts, control charts, process flow charts, histograms, scatter analysis, tally sheets, and check sheets.

However, the group also agreed that these SAMs were generally underused in industry and government. The primary reason these methods are not being utilized is a lack of awareness/education, not their ineffectiveness. The group agreed that the present lack of statistical thinking in the U.S. has been primarily caused by a lack of a thorough, applied statistical education at all levels in the U.S. educational system. Another problem identified by the group is academe's focus on theoretical statistics rather than on practical, applied statistics.

The group proposed some solutions to this problem in three different areas:

1. Increased emphasis on realistic, applied statistics in the formal education process:

    a. Elementary
    b. Secondary
    c. Undergraduate schools of science, engineering and business
    d. Graduate schools of science, engineering and business

2. Management Cultures

    a. Top management commitment and involvement in the use of these methods is sorely needed.
    b. Internal training programs in both government and industry must be established.
    c. Curriculum changes in undergraduate and graduate schools of science, engineering and business must be initiated without any further wait.

3. DoD Acquisition Process

   a. Major Department of Defense contractors must educate their customers and vendors about statistical and analytical methods (SAMs).
   b. The Department of Defense should not mandate the use of statistical and analytical methods by all defense contractors. Rather, the DoD should specify design parameter targets in terms of Cp and Cpk. Development and test programs would, therefore, require the use of designed experiments without being so specified.
   c. Source selection criteria would not evaluate contractors' use of statistical and analytical methods (SAMs). Rather, results of whatever tools were used would be evaluated.

WORKSHOP PROCEEDINGS
WORKSHOP # 5

INTRODUCTION

- Balancing Short-term Financial Goals with Long-term Investment Requirements - Linda Spencer, TRW Inc. The changing tax structure, defense business cycles, and economic variables of interest and inflation have major impacts on the desirability of investment. The use of capital, measures of return criteria, and the balancing of the interests of management, stockholders and creditors underlie concern for properly financing modernization. This workshop will evaluate current incentives and disincentives for capital investment. Key financial market issues will be identified. Ways for keeping short-term emphasis on profit and cash flow from discouraging long-term investment in modernization will be discussed.

PROCEEDINGS

Two major topics were addressed. They were:

The impact of cost-based pricing on defense contractor willingness to invest

The impact of tax policy on the cost of capital

Cost-Based Pricing -

In sum, current pricing policy doesn't reward efficiency and is counterproductive. The requirement for specific identification of cost on major system acquisition requires each contractor to maintain separate capability and accountability. The resulting segmentation is both inefficient and the cause of idle capacity.

The U.S. defense industry is no longer a unique sector, but largely an indistinguishable part of the overall U.S. industrial base. The defense industrial base (like the commercial industrial base) needs flexible manufacturing operations which allow multiple products to be manufactured efficiently in the same plant.

Emphasis on specific identification of cost of defense products complicates contractor efforts to take advantage of potential cost savings through large-scale purchases and/or mass production of system and subsystem components.

Furthermore, Department of Defense reluctance to encourage or reward investment in generic production capability discourages potential new sources from entering the defense industrial base. This is particularly true for start-up companies.

Relatively small quantity purchases, when combined with the requirement for segregation of cost, discourages investment in specialized production capability since recovery of the investment is tied directly to contracts of questionable duration.

The commercial sector is increasingly moving toward "group" and "niche" markets and so must the defense establishment, particularly in view of decreasing defense budgets. The technological shift within system architecture from mechanical to electronic functions and linkage provides an opportunity for the use of mass produced generic components, at least at the sub-system level. However, emphasis on segregation of cost by contract line item leads to small quantity purchasing and/or manufacturing efforts.

Another aspect of the cost-based pricing mentality in systems acquisition is the difficulty in acquiring increased quality.DCAA audit focus and training is on tracking costs incurred, cost allocability and allowability. The government seems to have more people concentrating on cost and profit measurement than on quality and productivity measurement.

Workshop participants raised a number of questions in this regard:

> How do you select a quality producer using accounting information as a differentiator?
>
> How do you put a price on quality?
>
> How do you balance quality improvements against Congressional and public stance against defense profits?

As one workshop participant stated, "The U.S. government must get on top of new accounting methods; those which encourage quality products." Another participant agreed, stating, "If I can deliver a quality product at a good price then the U.S. government should not look at my costs or my profit, but rather be satisfied that the first two conditions are met." (quality and price)

There was a general perception among participants that investment for increased productivity could be counterproductive for a defense contractor, for example:

> Shortened hands-on hours with fixed investment costs leads to increased overhead rates even though total cost may decrease.
>
> Cost savings after contract award can raise the spector of defective pricing allegations.

Such comments indicate a need for increased sophistication within the ranks of government audit personnel if the Department of Defense quest for increased quality and productivity is to be aided, rather than hindered, by government audit practices.

Tax Policy -

The Defense Financial and Investment Review (DEFAIR) findings indicated that sales and the cost of capital are two principal determinants of a contractor's willingness to invest in facilities and equipment. Since we can expect decreased defense spending, discussion focused on ways to reduce the cost of capital with emphasis on U.S. government tax policy.

Several ways to encourage saving and investment were suggested. These included:

Improving incentives for personal saving through expanded IRA or equivalent programs and expanded contribution limits on private pension plans.

Allowing faster investment cost recovery through full expensing in the year of acquisition, or at least, adopting faster depreciation rules than are currently in effect if full expensing is not politically feasable.

Allowing greater access to write-offs through expanded carryback and carry forward rules; access to tax losses through merger; and reinstatement of "safe harbor" leasing regulations.

Reducing multiple taxation of capital through full integration of the corporate and personal income taxes, or less sweepingly, ending the double taxation of dividends; ending or reducing both corporate and personal capital gains taxes.

Another impediment to modernization efforts by business is the lack of stability in the U.S. tax system. With tax laws changing every two years, there is increased risk to business which hamper the firm's ability to plan long-term. Increased willingness to "grandfather" tax laws on the part of Congress would reduce potential penalties of long-range commitment of capital to productivity and quality enhancing investments.

WORKSHOP PROCEEDINGS
WORKSHOP # 6

INTRODUCTION

- **The Industrial Modernization Incentives Program (IMIP)** - Dick Engwall, Manager of Advanced Manufacturing Initiatives, Westinghouse The subject of industrial competitiveness has become of increased cercern as the United States has been outpaced by its Free World trading partners in the rate of change in productivity increases. In the defense sector, the achievement of increased manufacturing efficiency and revitalization of the shrinking Defense Industrial Base has become an area of major concern. This workshop will address successes, failures and current trends in IMIP implementation. Focus will be placed on lessons learned to identify ways to optimize the modernization for both government and industry.

PROCEEDINGS

The workshop group received a partial charter during a morning session of the Conference during a panel presentation by Mr. Richard Donnelly, Assistant Deputy Under Secretary of Defense (Manufacturing & Industrial Policy). Mr. Donnelly discussed current IMIP implementation as "cumbersome" and discussed the need for streamlining this program. He noted that the current regulation (DODD 5000.44) was being rewritten and that inputs from the conference would be helpful.

The workshop attendees represented all services, industry and OSD. A well balanced and knowledgeable group took up the morning challenge of Mr. Donnelly. Mr. Dick Engwall, workshop leader, had provided a read-ahead package for each of the workshop members based on a previous conference of The American Defense Preparedness Association (ADPA). Dick opened the workshop by showing select viewgraphs which detailed the IMIP process including the interrelationship of IMIP with Man Tech and strategic planning. The group then focused on comments from Mr. Donnelly in the morning session and those of Mr. Jim Woodford, the person rewriting the IMIP regulation and one of the workshop participants. Dick Engwall then sought ideas from each of the participants as to what they saw as principle problems/concerns/issues with the current IMIP process. A round robin brainstorming methodology was utilized to enable consensus building. The ideas are shown as attachment 1. The group then categorized these ideas under the following topic areas:

- IMIP Program Objective
- Process Problems
- Administration Problems
- Cost Benefit Validation Impediments and
- Education Needs

The largest concern was for a new statement of "The Objective of IMIP". The group felt that a strong statement that encompasses four ideas was necessary. First, the goal of IMIP was to improve the industrial base and provide a benefit to the country. Secondly, the program should motivate investment at all tiers of business. Third, IMIP should provide an integration investment

strategy . A company's IR&D and capital investment should be integrated with DoD Man Tech and IMIP investment opportunities for maximum leverage. DoD acquisition strategy should recognize up front (Dem Val) need for IMIP for extraordinary modernization investment to offset business risk and cost-based pricing requirements. The last point was that some simplified quantifiable measure of total IMIP program success should be established. This was a critical point in that the group felt that it would be necessary for the IMIP program in total to show its success, yet in doing so did not require a large reporting or accounting system.

The group felt very strongly that the current IMIP program was encumbered with a system that attempted to provide to finite and exact a dollar savings on each investment and in doing so missed important investment opportunities. Simply stated, the need for validating overcame the objective of modernization investment. This misapplication is partially a result of focusing on short term stand-alone investments rather than a integrated factory process view.

The group agreed that new policy focus on the objective of IMIP, modernization, and less on the currently required factory analysis (IDEF) that demands excessive cost data that is incompatible with the contractor's cost estimating/pricing practices. The use of estimates of savings compatible with a companies cost estimating/pricing disclosed practices and reduction of excessive study efforts was proposed. The group wanted to be able to related the cost benefit of a program at the program negotiation level (Standard Form 1411 level).

Administration problems also currently are a significant impediment for many group members. The role of IMIP in the source selection process had become a problem since advent of the Competition in Contracting Act (CICA). It became apparent that different services and buying commands were experiencing conflicts in the source selection process when IMIP programs were proposed. How were the source selection officials to normalize proposals between contractors to make an award when one contractor has proposed an IMIP project and the others had not. It is recommended that the IMIP PSR be excluded. Secondly, IMIP is currently implemented by product contracts rather than process (multi-product), thus encouraging stand-alone non-integrated process improvement.

On the area of process problems, the group saw many that centered around data rights and intellectual property. In its recommendation, the group found the solution to this problem to be outside the realm of IMIP policy revision, but felt that within OSD the manufacturing and industrial policy gurus should insure that any solution does not interfere with the goal of IMIP to provide modernization in a most cost effective and timely manner.

The fifth problem strongly confirmed by all workshop members, was the need to educate the acquisition community, both Government and Industry, in general about IMIP at the Program Executive Office level. The major focus should be education for contracting officers and pricing analysts, but this was expanded to all levels and members of the acquisition community. The group recommended a joint industry/government effort to solve this need.

Lastly, the group identified the need to sell/track IMIP at the top level (industry sector, program, functional) both within Government and Industry. However, in reviewing our six key issues, it was felt that this last issue was being implemented and therefore was not a stand-alone issue as originally conceived by the group.

Although the group was strongly constrained by time, the use of brainstorming brought out a lot of ideas in a short time and focused the group on recommended solutions. Dick Engwall proposed that interested members continue to work together with the objective of setting a "white paper" for policy levels on the IMIP process. This was individually accepted by six members and this group will continue to work together, led by Jim Woodford OSD and Dick Engwall, Westinghouse.

ATTACHMENT 1 BRAINSTORMING IDEAS

1. Payoff/payback requirements are strongly $$$ constrained. Need to look at industrial base improvement also.

2. ROI versus national security benefit.

3. What is the measure of "goodness" or success for the IMIP program?

4. Industrial base advancement --- is it cost based only?

5. Phase 1 of the program --- is it valuable or predetermined?

6. Are the current requirements for savings validation cost effective?

7. In dual source environment, how does the contractor or government evaluate PSRs.

8. In source selection, do the criteria allow for IMIP?

9. The administration of PSRs is too hard and must be simplified.

10. The savings validation process must be simplified.

WORKSHOP PROCEEDINGS
WORKSHOP # 7

INTRODUCTION

- Flowing Policy Down To Suppliers - Nick Lambiase, Director of Purchasing, Texas Instruments. A range of controls, guidelines, and effects of federal and customer policy will be addressed as it applies to suppliers, primes, and upper tier vendors. Thinking as to what is passed to suppliers in total, in part, or not at all will be aired. Suggestions will be developed for policy makers which will help account for the depth and breadth of impact when revising or issuing policy.

PROCEEDINGS

The typical contractor spends approximately 50% of its net sales dollars with its suppliers; the control of those suppliers is critical to contract performance.

Policy flow downs come in at least two types; mandatory and optional. Mandatory flow downs are usually specified by law or regulation. Optional flow downs are usually business decisions driven by customer requirements.

There is a potential third type of policy flow down that the social or good neighbor type programs which may not be mandated by law or regulation.

SUBCONTRACTING MANAGEMENT HANDBOOK, First Edition - 1988, Chapters 3, 7, and 9 and Appendix C, entitled "Subcontract Flow Down Clauses; Federal Acquisition Regulation (FAR)" (Developed by R.V. Lieg).

SUGGESTIONS:

1. Industrial Modernization Incentive Program (IMIP)

    a. DOD should not require its prime contractors to flow down IMIP requirements to its subcontractors. A mechanism should be developed to allow subcontractors to participate in the IMIP directly with DoD.

2. Source Selection

    a. Source selection should be based upon performance criteria specified in the solicitation. Subcontractor rating systems must by directly related to demonstrated past performance based on results with the specific performance criteria. Accordingly, selection criteria should be tailored to the item being procured..

DISCUSSIONS:

1. Subcontract flow down

    a. Industry has major problems in flowing down prime contract requirements to subcontractors. Generally, the prime contractor passes the requirements to its

subcontractors, who have no real way to cope with them. Subcontractors generally do not reject orders from the prime, knowing full well some provisions are impossible to perform. Subcontractors understand the nature of the prime's buying environment, and realize if they take exceptions to flow down requirements in a competitive environment they will not be considered for an award. Subcontractors appreciate their options, but from a practical point of view they do not reject orders because of pass down's (with minor exception).

b. Flow down requirements tend to be in the area of control and are not positive in nature. Prime contractors should be realistic in passing down requirements. Some change in law and regulations are needed to encourage positive actions to encourage subcontractor action. For example award fee's for capital investments.

2. IMIP

a. Examples were discussed where prime contractors were required to flow down IMIP's to subcontractors. This approach creates requirements that may conflict with the normal and usual business practices for making capital investments by the subcontractor. Further, the administrative requirements associated with IMIP may in fact discourage the subcontractor from making a capital that it may have made under normal return on investment decision criteria.

3. SUPPLIER BASE

a. The defense supplier base is being reduced by many prime contractors to improve quality and strengthen business relationships. The Government may have a negative reaction to these changes from the stand point of reduced competition to total quality are real savings in program cost, improved efficiency, and a adequate, higher prices, and a reduced industrial base. Industry results demonstrate their commitment supplier base.

b. An example of this action is the Harris Corporation preferred supplier program which was described as reducing high dollar/difficult item suppliers from approximately 2500 to 300 suppliers over the past few years. Preferred suppliers were selected for annual ordering agreements based upon results oriented selection criteria that included; past performance, 3 to 5 suppliers for each commodity family, limited order to 30 % of a subcontractors total business, small and disadvantages business, and 10 other criteria.

WORKSHOP PROCEEDINGS
WORKSHOP # 8

INTRODUCTION

- Are Industrial Networks and Product Data Exchange the Future? - Mr. Bruce Lepisto, Deputy Director, CALS, Office of the Secretary of Defense To stay competitive, companies are now investing in the evolution from islands of automation to enterprise integration and toward multi-enterprise networks of trading partners doing business in a near-paperless environment. Capabilities exist that place us on the threshold to major breakthroughs in this area. Participants will prioritize the technical and business issues involved in this evolution, and will recommend appropriate government facilitating roles.

PROCEEDINGS

Mr. Bruce Lepisto, Workshop Leader, opened the session with an overview of the workshop objectives (See attachment to these minutes). These opening remarks were followed with discussions on what the panel felt were the important issues affecting eight issues were deemed to be the most important ones affecting both government and industry networks.

ISSUE 1:

HOW DOES ONE WEIGH THE COST OF THE PROBLEM VERSUS THE COST OF THE SOLUTION?

DISCUSSION:

When examining implementation of any network, cost (both life cycle and unit cost) must be a major consideration along with such other items as schedule and quality. In particular one must consider the problem of who bears the cost of the solution (i.e., who supports the basic framework of any network).

ISSUE 2:

HOW DO YOU IMPROVE THE PROCESS OF GENERATING STANDARDS?

DISCUSSION:

The process of creating and evolving industry wide standards must take into account the duality of all information. That is, information is equal to data plus meaning. Too often standards concentration too much on the technical side, that is the data, without giving the cultural or linguistic side, the meaning, sufficient consideration.

ISSUE 3:

WHAT WILL BE NEEDED BEYOND THE CURRENT TECHNOLOGY?

DISCUSSION:

Current technology centers around systems such as the Product Data Exchange Specification (PDES). Future systems, however, will evolve that may not even resemble current systems. These systems may be influenced by other technologies such as superconductors or bio-technology, in unforseen ways. What will be needed 5-10 years downstream? How much can the government influence it? How much will culture influence it?

ISSUE 4:

HOW DOES ONE CLASSIFY AND PRIORITIZE THE DATA?

DISCUSSION:

Although everyone agrees that accurate data is always needed, the question arises as to how much data is needed, what type of data is needed and how do you prioritized the data. Too often data is generated at great cost that rarely if ever is used by anyone.

ISSUE 5:

HOW DO YOU INSURE THAT SYSTEMS CAN EVOLVE AND KEEP WITH ANY NEW EMERGING TECHNOLOGY?

DISCUSSION:

If one is not careful, systems can by built at great cost but, because of the way they are designed, very quickly become obsolete and unable to be modified. An example was given of a company that developed a large, multi-million dollar data system that became too expensive too maintain and too important to eliminate. The way to get around this is to be able to build modular, open architecture that will allow new technology to be blended into the system without too much trauma or cost.

ISSUE 6:

HOW DO YOU CONTROL ACCESS TO THE NETWORKS IN TERMS OF SECURITY, CONTROL AND COSTS?

DISCUSSION:

A means must be found to control access to all networks particularly because of security requirements. For the government this is a major issue considering the fact that data bases may be classified. But industry will also have concerns because they will not be too happy to have their proprietary and company sensitive information readily accessible by the public at large.

ISSUE 7:

HOW DO YOU ALLOW THE GOVERNMENT MORE ACCESS TO LOWER-TIER CONTRACTORS OR VENDORS?

DISCUSSION:

A common problem which faces the government is the fact that it has very limited access to subcontractors and vendors who support the prime contractors. It was agreed that digital technology will allow the government greater access to vendor developed and shared data bases. The negative side of this is that not all of industry will be all that thrilled to have the government have even greater access to their inner workings. Some of them feel that the government already has too much to say about how they do business and this often drives up their cost without really adding any value to the product.

ISSUE 8:

HOW DOES THE GOVERNMENT INCENTIVIZE THE CREATION AND EVOLUTION OF AN OPEN ARCHITECTURE?

DISCUSSION:

The government must not be a hindrance to the creation to an industry wide architecture. To a great extent industry tends to gravitate towards mutually acceptable standards on their own. An example of this is the Unix system. Whatever policy or standards the government either creates or espouses must not hinder the process of evolving to a widely accepted, modular architecture.

The panel made an attempt to prioritize the eight issues, but gave up because all of the issues seemed important. The conclusion, however, was that all the issues raised needed to be considered together because of the synergistic effects inherent in them.

WORKSHOP PROCEEDINGS
WORKSHOP # 9

INTRODUCTION

- The Use of Multi-functional Development Teams - Brian Wright, Vice President and Director of Engineering, ITT Aerospace/Optical Division Concurrent engineering is an emerging trend in product development with teams being formed early in the development cycle to ensure a smooth transition of the design from concept to production. How can the traditional functional barons be converted to advocates in this field? What are the paradigms which inhibit this process between government and industry? What type of changes are necessary to facilitate growth of this concept? How can it help you? Participants will be asked to contribute ideas regarding impediments and solutions to those impediments to facilitate the implementation of concurrent engineering.

PROCEEDINGS

The Group leader, Mr. Brain Wright opened with a brief discussion of a Concurrent Engineering Concept based on a number of reports published in various journals over the preceding few years. It was intended to provide a background for discussing problems involved in competing in a world market where quality is measured in defective products per million rather than the current U. S. achievement of defective products per hundred. Some particular points made were that the U. S. need to:

1. Build quality in rather than inspecting at the end of the line.

2. Improve employee involvement: U. S. employee suggestion rate is less than 1 improvement suggestion per employee; Japan averages 40 improvement ideas per employee per year, (Toyota is approaching three digit suggestion rates).

3. Decrease dependency on unique people ("the Superman Syndrome") to solve problems and move toward reliance on teams.

4. Make improvements a win-win process, not a zero sum game.

5. Change from a management priority sequence of cost, schedule, quality; to one of quality, schedule, cost.

6. Change current organization practice: large vertical structures makes problem solving very time consuming and generates a stovepipe mentality. Such organizations can't compete with such long times between problems and their solutions. For the 90's we need to be fleet of foot and flexible.

7. Give more emphasis to how things are designed - foolproof the design so that it can only go together one way.

8. Provide more visibility into what the systems are and how they work.

9. Include vendors within the design process activity.

10. Adopt the idea in Einstein's quotation: "The thinking that got us where we are today is not going to get us out of the problem."

Some illustrations of Mr. Wright's other points are at Appendix #2. The group was then asked to develop issues concerning use of multi-functional development teams. The 24 specific issues developed are at Appendix #3.

The group then considered all of the issues and defined three general problem statements which incorporated almost all of the 24 issues in Appendix #3. The three general problem statements were:

1. Remove cultural and traditional barriers

2. Establish realistic funding levels

3. Encourage excellence without legislation

Appendix #4 indicates those particular issue statements which group within each of the three major issue statements.

The discussions about grouping also developed some solution ideas. Appendix #5 lists those ideas under the appropriate statements.

APPENDIX #2
ILLUSTRATIONS OF POINTS MADE IN MR. WRIGHT'S DISCUSSION AND THE CONTEXT OF THOSE ILLUSTRATIONS

Mr. Wright used charts to illustrate various points he made during the introduction to the workshop. Figures 1 through 7 served as the basis for the introductory remarks.

Figure 1 - Tomorrow's competition is becoming increasing more proactive in their approach to quality and innovation. Contractors can no longer expect to inspect quality in but must now rely upon process engineering and process control to effectively produce quality in the parts per million range. Six sigma quality results in only 3.4 defects per million! Use of the entire workforce being involved in continuous improvement must be stressed both in the defense contractor base and within the government itself.

Figure 2 - We must recognize the need for the human being in the process. Too often we are dazzled with the elegance of the technology and we forget the man machine interface. Money and new capital is not the solution to all the problems. Many U.S. industries have found that older capital equipment is just as capable as newer equipment provided the processes are engineered and dedicated to the machine's process capabilities. These factors must be considered early in the design phase to insure success.

Figure 3 - Designs developed in isolation and "thrown over the wall" traditionally have resulted in cost increases during each phase of development. The concept of Simultaneous or Concurrent Engineering reduces the effects of this problem by coupling the various disciplines together and focusing them on the customers true requirements for the product.

Figure 4 - Paradigms exist! One only need look around at the organizations you work with on a daily basis to see the effects of paradigms. Turf battles, fiefdoms and baronies must be eliminated if constant improvement is to effectively take hold within any organization. The quote at the bottom of the figure exemplifies the problem.

Figure 5 - Even though the traditional organization will be with us for the forseeable future we must learn to work horizontally through the organization with our focus constantly on the voice of the customer. Elimination of the stove-pipe mentality of the traditional organization will only result when the paradigms are changed to focus the organization on the customer's requirements.

Figure 6 - A composite illustration which ties it all together. Note the integration of many of the principles of Total Quality Management in the center box labeled Concurrent Engineering.

Figure 7 - Presents several sources for quality improvement. Note the emphasis within the figure is placed on People, Focus and Processes. People serve as the action elements in the improvement process, management focus on the problems is mandatory if the end goal is to be achieved and knowledge of the process and its capabilities and limitations is paramount to being able to effect improvement.

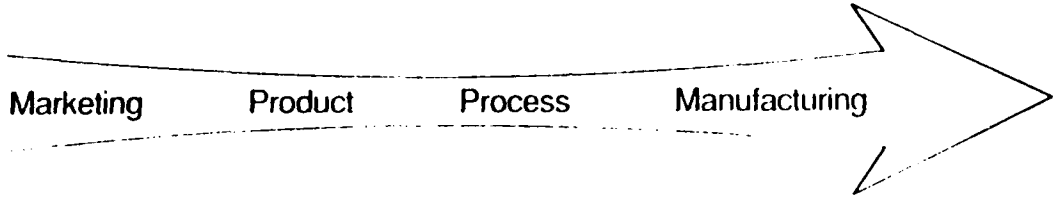
TOMORROW'S COMPETITION

INDICATOR	TRADITIONAL PERFORMANCE	TOMORROW'S COMPETITION
QUALITY	MEASURED IN PARTS/HUNDRED	USING PARTS/MILLION
	"DON'T FIX IT UNLESS IT'S BROKE"	CONSTANT IMPROVEMENT
	HEAVY RELIANCE ON INSPECTION	INCREASED EMPHASIS ON PROCESS CONTROL
	QUALITY COSTS = 20+% OF SALES	QUALITY COSTS = 5% OF SALES
INNOVATION	<1 IMPROVEMENT IDEA IMPLEMENTED PER EMPLOYEE PER YEAR	>40 IMPROVEMENT IDEAS IMPLEMENTED PER EMPLOYEE PER YEAR
	DEPENDS ON INDIVIDUALS	DEPENDS ON GROUPS/TEAMS
	EMPLOYEE MEANS ANYONE EXCEPT MANAGEMENT	EMPLOYEE MEANS EVERYONE
	WIN-LOSE/ZERO SUM GAME	WIN-WIN/ADDED VALUE

TOMORROW'S COMPETITION

INDICATOR	TRADITIONAL PERFORMANCE	TOMORROW'S COMPETITION
TECHNOLOGY	DEDICATED	FLEXIBLE
	COMPLEX AND SOPHISTICATED	APPROPRIATELY COMPLEX
	HI TECH LOW TOUCH	HI TECH HIGH TOUCH
	MONEY/CAPITAL WILL SOLVE PROBLEMS	LET THE PEOPLE IN THE SYSTEM TELL US WHERE THE CAPITAL AND TECHNOLOGY ARE MOST NEEDED
	ISLANDS OF IMPROVEMENT	INTEGRATED AND ORCHESTRATED COMPANY WIDE IMPROVEMENT
INVENTORY	JUST IN CASE	JUST IN TIME
CONTRACTUAL	COST; SCHEDULE; QUALITY	QUALITY BASED ON CUSTOMER REQUIREMENTS AND PERCEPTIONS; THEN SCHEDULE AND COST
BOTTOM-LINE	MAXIMIZE EFFORTS TO CONTAIN NEAR TERM PROFIT EROSION	INVEST ENERGY IN LONG-TERM GROWTH, COMPETITIVENESS AND IMPROVEMENT TO BE THE BEST

Simultaneous Engineering



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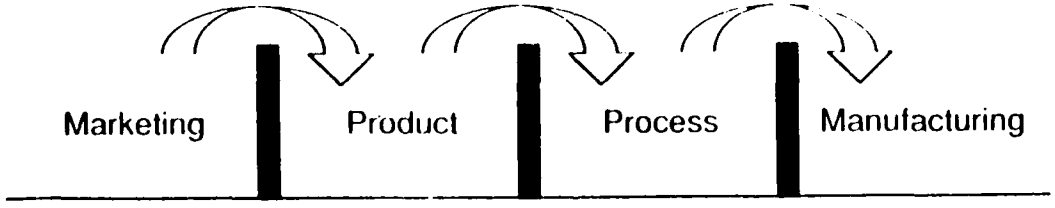
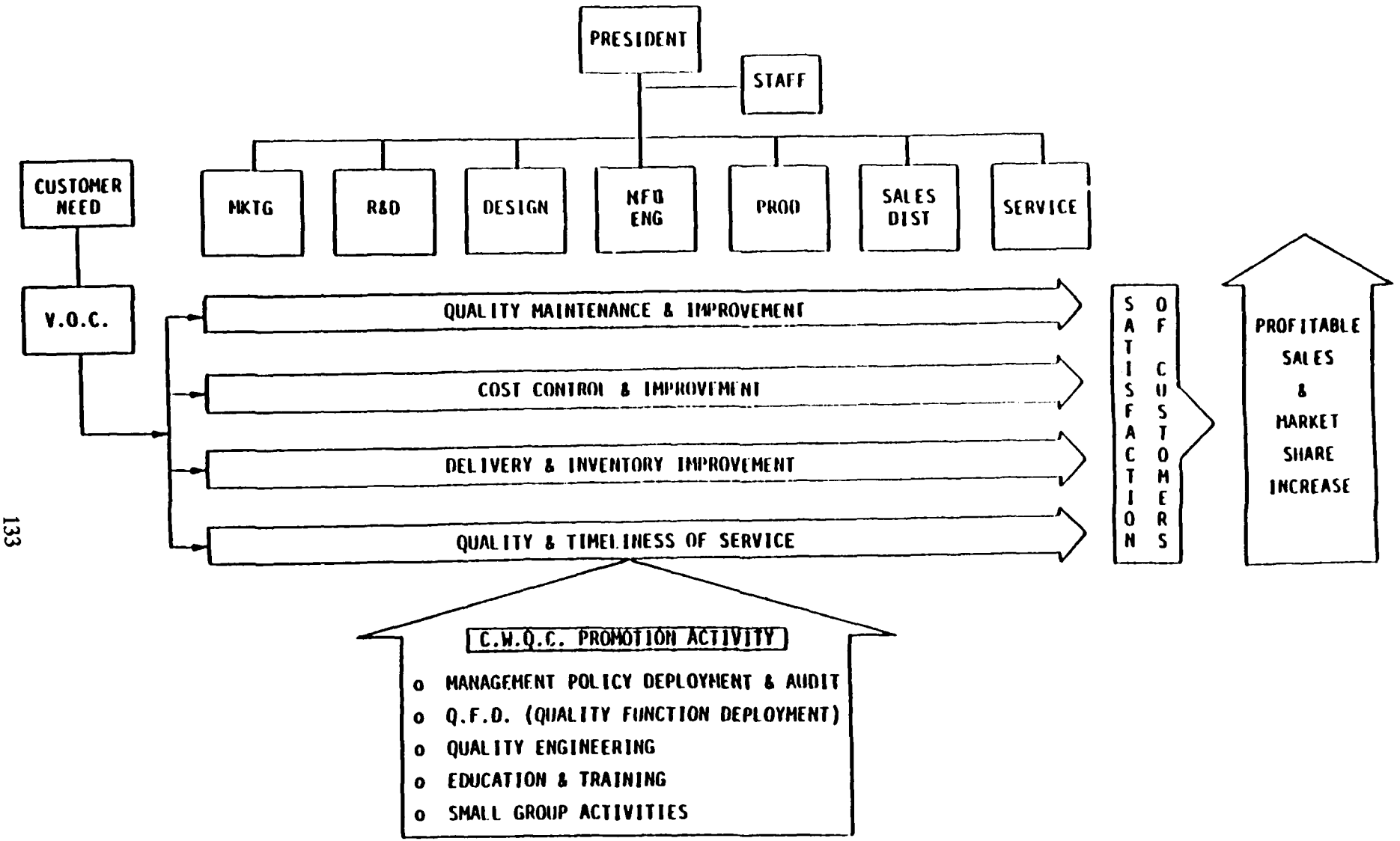


PARADIGMS

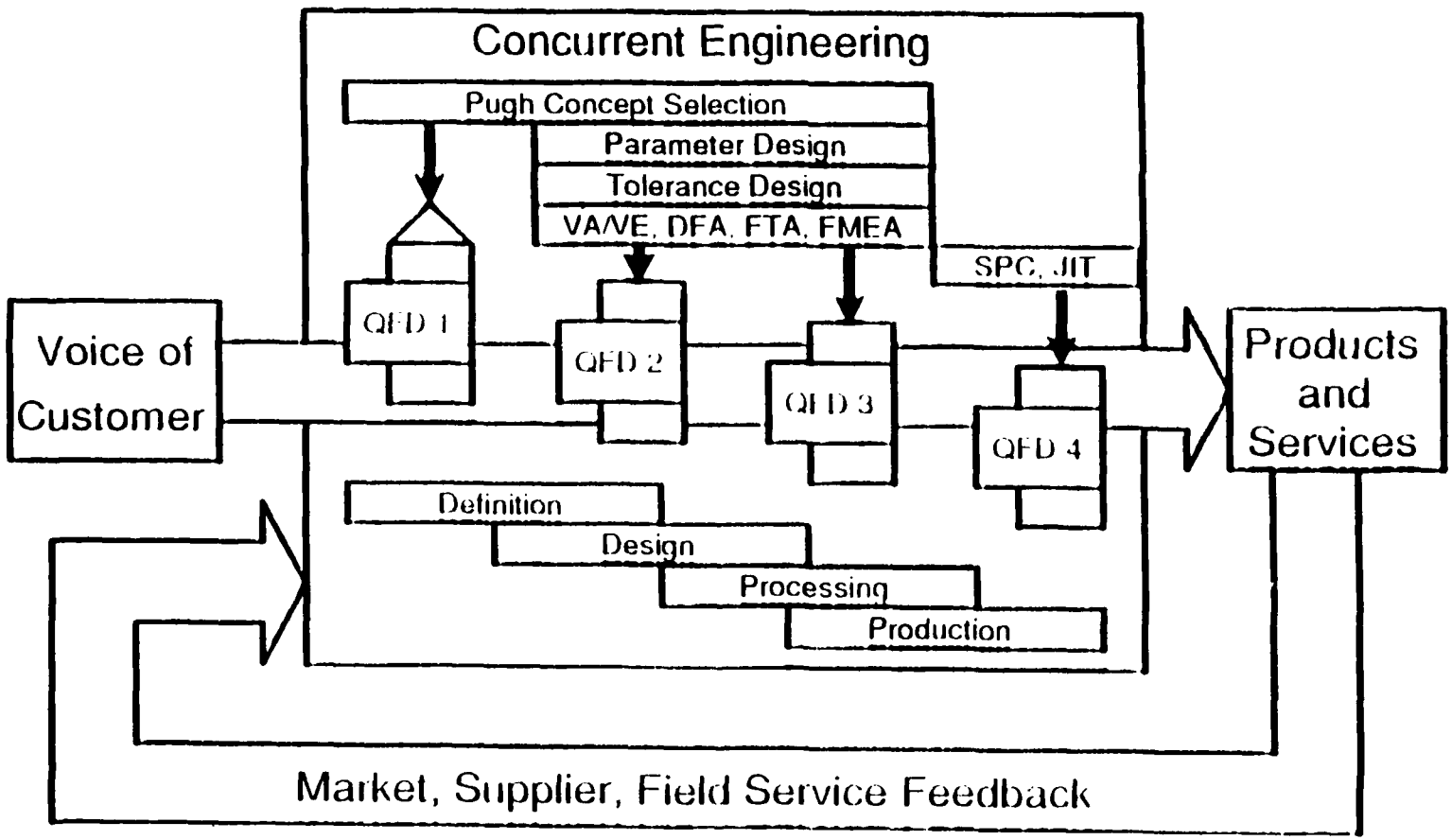
- DEFINITION - A MODEL, MOLD, IDEAL, STANDARD OR PATTERN FOR BEHAVIOR
- EXAMPLES ARE OFTEN INFORMAL BUT ARE STRUCTURED WITHIN A FORMAL FRAMEWORK
- CONSIDER THE CLASSIC ORGANIZATION CHART WITH ITS FUNCTIONAL ORGANIZATIONS EACH ORGANIZATION HAS FORMALLY OR INFORMALLY CARVED OUT ITS "TURF" OR PARADIG
- PARADIGMS WITHIN A FUNCTIONAL ORGANIZATION LEAD TO VERTICAL DECISION MAKING AND THE SILO EFFECT
- PARADIGMS RESULT IN WHAT MAY BE TOTALLY OBVIOUS FOR ONE BEING TOTALLY IMPERCEPTIBLE TO SOMEONE FUNCTIONING OUTSIDE OF THE PARADIGM
- STRICT ADHERENCE TO PARADIGMS BY FUNCTIONAL ORGANIZATIONS LEADS TO PARADIGM PARALYSIS WHERE EACH MEMBER OF THE ORGANIZATION BELIEVES THAT THEIR PARADIGM IS THE ONLY PARADIGM - SYMPTOM IS "YABUT" IN RESPONSE TO ANY SUGGESTION OR INNOVATION

"THE THINKING WHICH CREATED TODAY'S PROBLEMS IS INSUFFICIENT TO SOLVE THEM."
A. EINSTEIN



FUNCTIONAL MANAGEMENT

TQM Product Development



SOURCES OF QUALITY IMPROVEMENT

PEOPLE
- PARTICIPATION
- DECENTRALIZED RESPONSIBILITY - EMPOWERMENT
- MULTIFUNCTIONAL CONTRIBUTORS TO IMPROVEMENT

FOCUS
- ALWAYS ON THE CUSTOMER
- DISCIPLINED AND METHODICAL
- IMPROVEMENT TARGETS QUANTIFIED
- SYSTEMATIC AND SYSTEMIC

PROCESSES

PHYSICAL -
- IMPROVED LAYOUTS
- FLEXIBLE EQUIPMENT AND TOOLING
- FOOL-PROOF/FAIL-SAFE

SYSTEMS -
- VISIBLE
- INTEGRATED CYCLES OF ACTIVITY
- CYCLIC REVIEW AND IMPROVEMENT

SUPPLIERS -
- LIMITED BASE
- MULTIFUNCTIONAL CONTACT WITH EACH
- QUALITY PROCESSES VERIFIED AND VALIDATED AT EACH
- PATTERNED/PLANNED MATERIALS NEEDS WITH EACH

APPENDIX #3
STATEMENTS OF ISSUES INVOLVED IN PERFORMING CONCURRENT ENGINEERING METHODOLOGY AS DEVELOPED BY WORK GROUP #9

1. How to encourage use without contractual requirement
2. Cultural and traditional barriers (people)
3. Short term versus long term planning
4. Fix-it later (lack of design process and schedule control
5. Measurement and feedback from customer community
6. Focus of accountability --> Engineering/Program Management Office omits Quality Assurance and Manufacturing.
7. Shifting focus of accountability
8. Tools: Communication and automation to support concurrent engineering
9. Micro-management - Additional requirements and oversight
10. How to integrate concurrent engineering with test-fix-test philosophy
11. How to "schedule" diverse organizational participants
12. Funding profiles for concurrent engineering
13. FARS etc. that are <u>really</u> impediments - do they exist?
14. How does Government fund a multi-disciplined team for contract oversight? Is it really needed?
15. Functional organization - barrier to a team approach
16. Facilities for team organization
17. Producability - cost trade-off - verification - measurement metrics
18. Flow of funds
19. Source selection criteria - weighting factors and measures
20. Contractor expense through B&P for defining approach
21. In-house facilitator/consultant
22. How to hear voice of customer

APPENDIX #3 (CONTINUED)
STATEMENTS OF ISSUES INVOLVED IN PERFORMING CONCURRENT ENGINEERING METHODOLOGY AS DEVELOPED BY WORK GROUP #9

23. Should DoD really care if contractors adopt process - emphasis is on DoD as a customer

24. Incentives from Government and potential recourse for failure

APPENDIX #4
GROUPING THE 24 ISSUE STATEMENTS WITHIN GENERAL HEADINGS

The 24 issue statements were used to derive some general headings within which broad issues could be stated. The following general statements were derived.

GENERAL STATEMENT #1: Remove cultural and traditional barriers
INCORPORATES THE FOLLOWING ISSUE STATEMENT IDEAS

2. Cultural and Traditional barriers (people)
3. Short term vs long term planning
4. Fix it later (lack of design process schedule control)
6. Focus of accountability --> Engineering/Program Management Office omits Quality Assurance and Manufacturing
7. Shifting focus of accountability
9. Micro-management - additional requirements and oversight
10. How to integrate concurrent engineering with test-fix-test philosophy
11. How to "schedule" diverse organizational participants
15. Functional organization - barrier to a team approach
16. Facilities for team organization

GENERAL STATEMENT #2: Establish realistic funding levels
INCORPORATES THE FOLLOWING ISSUE STATEMENT IDEAS

12. Funding profiles for concurrent engineering
14. How does Government fund a multi-disciplined team for contract oversight? Is it really needed?
17. Producability - cost trade-off - verification - measurement metrics

GENERAL STATEMENT #3: Encourage excellence without legislation
INCORPORATES THE FOLLOWING ISSUE STATEMENT IDEAS

13. FARS etc., that are <u>really</u> impediments - do they exist?

APPENDIX #4 (CONTINUED)
GROUPING THE 24 ISSUE STATEMENTS WITHIN GENERAL HEADINGS

19. Source selection criteria - weighting factors and measures

20. Contractor expense through B&P for defining approach

23. Should DoD really case if contractors adopt process - emphasis is on DoD as a customer

24. Incentives from Government and potential recourse for failure.

APPENDIX #5
SOLUTION IDEAS GENERATED

Listed below are the solution statements developed for each of the 3 broad issues statements derived from the original 24 issues developed by the work group. Some of the solution statements are statements of one of the original 24 issue statements.

CULTURAL AND TRADITIONAL BARRIERS

- Top management gets committed
- Accountability by team
- Facilities for co-location
- Clarification of responsibilities
- Compensation equity/equality
- Incentives
- Communications improvement
- Design tools

STRUCTURING CONTRACTING PROCESSES TO ACHIEVE BEST VALUE TO THE CUSTOMER (ENCOURAGE EXCELLENCE WITHOUT LEGISLATION)

- See
- Read
- Measure

→ Government to Contractor

→ Contractor to Customer

- Remove disincentives to application of Concurrent Engineering/Total Quality Management practices.

REALISTIC FUNDING LEVELS TO SUPPORT CONCURRENT ENGINEERING

- Move P3I funds up-front
- Plan for pilots/prototypes
- Define the process

APPENDIX #5 (CONTINUED)
SOLUTION IDEAS GENERATED

- Training before assignment
- Remove prohibitions on use of IR&D for process development

WORKSHOP PROCEEDINGS
WORKSHOP # 10

INTRODUCTION

- **What is Needed in Curricula To Cover Industrial Modernization?** - Dr. David Cleland, Department of Industrial Engineering, University of Pittsburgh Are the historic technical and business curricula totally adequate to the challenges of modernization? Those views are not universally endorsed. The differences will be drawn and suggestions made.

PROCEEDINGS

The participants in this workshop had a spirited and useful discussion of some of the issues facing educational institutions in preparing graduates for careers relating to industrial modernization. The following conclusions and supporting recommendations are submitted.

Total quality management (TQM) of educational curricula is required to provide the programs of instruction needed to produce quality students who have the necessary technical and managerial knowledge, skills, and attitudes to contribute to industrial modernization strategies. The quality of educational programs at all levels - from grade school through high school and undergraduate and graduate college and university programs - is a "systems" problem. The "stakeholders" of the educational system are parents, teachers/faculty, school administrators, local industry, churches, social and professional organizations, and the general public. Each of these stakeholders has the responsibility to contribute to the quality of education.

Efforts must be undertaken to ensure better integration of industry needs and capabilities with educational strategies. Cooperative programs, apprenticeships, and opportunity for the students to have real world experiences are vital to ensure students receive a well-rounded education. Education cannot be accomplished apart from the real world; rather, it should be carried out within the context of the environment where the graduating students will have the opportunity to demonstrate their knowledge, skills, and supportive attitudes.

Continuing educational programs comprised of short-term courses to update knowledge and skills are needed because of the rate of change of technologies.

Work experience is essential to produce a well-rounded student. This work experience can come about through cooperative educational programs, summer employment, and other cooperative arrangements between educational institutions and prospective employers. Obsolescence is a threat to all professions. Graduates will have to undergo training by educational institutions or in-house industry programs. There is considerable evidence to suggest that the rate of increase of company in-house training programs is caused by inadequate original programs of instruction.

A key question in the business of education is: What are the incentives for the schools, colleges, and universities to provide excellent programs of instruction for industry? Some answers to this question are: (1) rewards for turning out quality students; (2) funding of research by industry users; (3) a better qualified work force, i.e., one that can contribute meaningfully to the enhancement of the competitiveness of companies/industries involved.

There has been a decline in the number of United States (U.S.) students entering technical/engineering undergraduate and graduate courses. In the long-ran this decline will pose serious competitive problems for the United States. Incentives must be developed to encourage more U.S. students to enter technical/engineering courses.

Community colleges are making significant contributions to educating the work force. Both education and technical training in a trade skill in these colleges need to be expanded and integrated into high school curricula. Because many high school graduates do not go on to college, these graduates should be given an opportunity to develop trade skills in high school so, upon graduation, they can begin their apprenticeship in a trade.

In part, the decline of U.S. competitiveness in manufacturing can be attributed to a lack of leadership. This deficiency can be corrected by offering engineering/manufacturing courses that provide an opportunity to develop the knowledge, skills, and attitudes required by managers and leaders of industry.

Technology is not the problem in the U.S. decline in engineering and manufacturing work. The problem is **management** of the technology -- the judicious application of technology in both **product** and **process** design.

Enterprise managers require more education leading to a greater appreciation of the role of engineering and manufacturing as competitive factors in the general management of the enterprise. Business managers (especially MBA graduates) must have adequate exposure to engineering and manufacturing disciplines so that a full appreciation is gained of the importance of these functions in the success of business enterprise.

The time required for a college education today, particularly in engineering and other technical disciplines, needs to extend beyond the almost traditional four years. Five and six years are required to adequately address some of these disciplines. The pace of change in all technologies today requires a more strategic management of the design, development, and implementation of the curricula. State-of-the-art knowledge and skill needs to be acquired, and it should be built on a sound and strong foundation, which includes mathematics (algebra, geometry and statistical methods), physics, chemistry, and the basic elements of engineering drawing and design. Later, elements of manufacturing need to be addressed. Then, of course, the individual's specialization needs to be covered with some thought given to basic economy, business and law, as well as good management practices.

The attributes of ethics, trust, loyalty, commitment, and respect for team members are important skills and attitudes in most industrial organizations. The continuing use of program/ project teams, production teams, task forces, and other team-directed organizational units requires that students receive education and training in team participation. Organizational development programs within companies are a key element of continuing education because they keep employees alert to the importance of teamwork in producing quality products and services.

Educational stakeholders should not consider the curricula or process to be fixed. As changes come about in the social, political, economic, competitive, and technological elements of the industrial community, adjustments will be required to keep the curricula relevant.

Some of the courses that need more emphasis today include: communication skills, engineering economics, concurrent engineering, engineering and manufacturing management, program/ project management, total quality management, reliability, and maintainability.

The bottom line assessment by the panel members was that education is a "systems" business. Poor quality students, not technology, have created a problem for the stakeholders of U.S. educational institutions. This problem must be dealt with firmly and positively, because the educational process must be able to deliver quality students to the user communities.

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BIBLIOGRAPHY

1. Berger, Suzanne, et al, "Toward A New Industrial America," Scientific American, Vol 260, No. 6, June 1989,, pp. 39 - 47.

2. "Bolstering Defense Industrial Competitiveness," Report to the Secretary of Defense by the Undersecretary of Defense (Acquisition), Department of Defense, July 1988.

3. "Defense Manufacturing Management Guide For Program Managers," Defense Systems Management College, (Ft. Belvoir), April 1989.

4. "Integrating Industrial Preparedness Into The Acquisition Process, A Guide for Program Managers," First Edition, Defense Systems Management College, (Ft. Belvoir), April 1989.

5. "Managing Quality and Productivity in Aerospace and Defense," Defense Systems Management College, (Ft. Belvoir), November 1989.

6. Schlefer, Jonathan, "Making Sense of the Productivity Debate: A Refection on the MIT Report," Technology Review, August - September 1989, pp. 28 - 40.

7. "The U.S. Defense Industry," Ernst & Young, E & Y No. A58051, 1989.

8. Thurow, Lester C., "America Adrift," The Washington Post," February 11, 1990.